# ELECTRICAL WORLD

*A Consolidation of Electrical World, Electrical Engineer and American Electrician*

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## What in the World!

Always eager to learn, we glean from a contemporary that "The conservative press, loud in praise of the President when he cuts payments to veterans and Federal employees, grows distinctly chilly in tone as he moves to make good his campaign pledges on Muscle Shoals," and further, that "In the Muscle Shoals region, waiting to be tapped as soon as that power is available, are five billion tons of iron ore, 70 billion tons of coal, 75 million barrels of oil, the largest deposit of phosphate rock in the world etc."

●

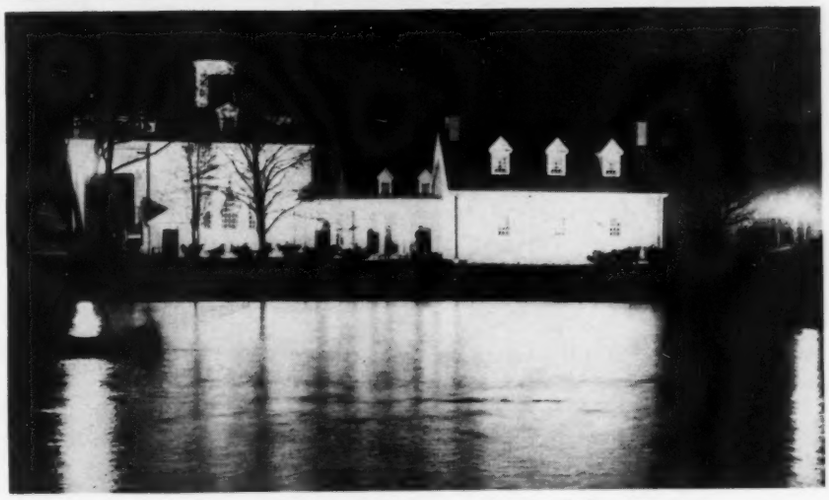
It is our notion about the ambitious Tennessee Valley scheme that President Roosevelt is not only fulfilling campaign promises but paying off a few score political debts, that he has agreed to put men to work and can find no readier way to do it, that the whole thing is and will prove itself to be a monstrous economic blunder, - - - - but - - - - that it will divert a lot of attention when attention can well be diverted.

●

As to its opening up great stores of natural resources, the answer is "What of it?" America is rolling in natural resources and all the iron, coal, oil, bauxite, power, and production facilities that it can use at any price.

●

Loud cries of distress arise from our friends who find rate reduction pressure all-but-irresistibly strong. Sincerely we say that the necessity and its inevitable aftermaths are tragic—and yet—there are not likely to be any exceptions, any privileged industries, in the heart-breaking struggle for renewed economic health that is to precede better days.



*Floodlighting Mount Vernon replica, New York*

## APRIL 22, 1933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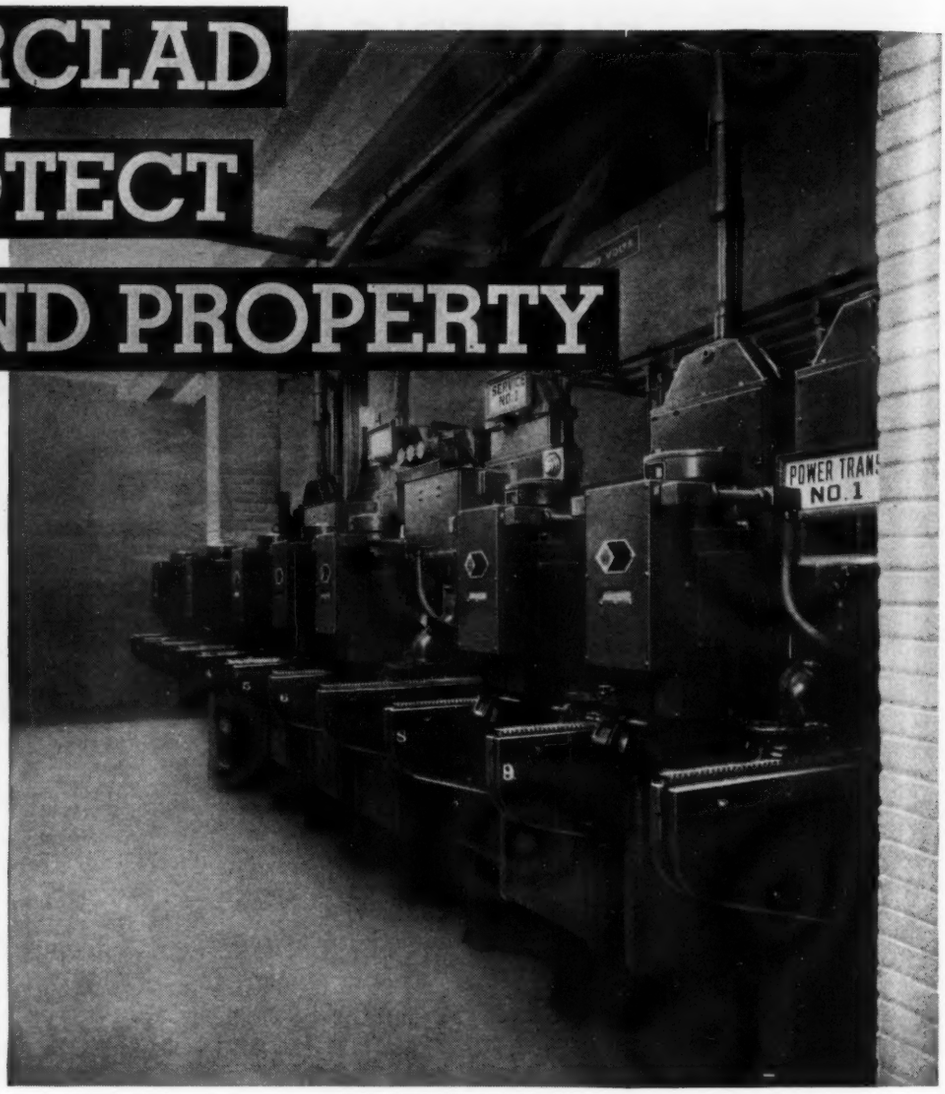
# ARMORCLAD TO PROTECT LIFE AND PROPERTY




9 - 600 amp. 1500 volt. Armorclad Switchgear units in Philadelphia Safety Fund Building. Howe and Lescase, architects; H. B. Hackett, consulting engineer; building erected by George A. Fuller Construction Company; Switchgear installed by Howard P. Foley Company. Allis-Chalmers also supplied the building transformers.

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# ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

*for the Week Ending*

April 22, 1933


## Utility Executives Voice Opposition to Tennessee Valley Project

THOUGH no definite enabling action had been taken, at the time of going to press, on the program proposed by President Roosevelt for the development of the Tennessee Valley, with the initiatory step to consist of Muscle Shoals activity, the military affairs committee of the House of Representatives wrote some important limitations into the House bill. The Norris bill was reported out of committee after but a twelve-minute executive session last week. The Senate committee's favorable action carried no amendments.

### Many protests heard

Representatives of power companies, the United States Chamber of Commerce, the National Fertilizer Association and some other organizations either appeared before the House military affairs committee to testify regarding the measure or voiced opposition to it, but while important questions were raised and major difficulties pointed out it is doubtful that the measure will be defeated.

W. L. Willkie, president of the Commonwealth & Southern Corporation, whose six operating power companies would be most affected by the competition offered by the distribution and sale of large amounts of power in that region, told the committee that "the senior securities of the Commonwealth & Southern system in the southern states are in amount $400,000,000. These securities are owned by thousands of people, and the preferred stock . . . has been widely distributed . . . in that territory . . . Every one of those securities, represented by actual dollars invested, was approved at the time of their issuance by the public service commissions of the respective states...I do not want to be in the position of an alarmist, and I do not want to overstate any situation, but I can say to you, as my deliberate judgment, that if this bill passes, this $400,000,000 worth of securities will be eventually destroyed." Mr. Willkie pointed to the specific danger in the provisions for government-owned-and-operated transmission lines and the board's authority to build them.

"If," continued Mr. Willkie, "the passage of this bill is imperative for the welfare of this country, then the interests of these investors should be sacrificed . . . I agree that if it is best for the nation that we give ourselves to its services we should do so, and likewise we should give our property, but there is a constitutional provision which says that if you take private property for the benefit of the public there shall be compensation made. Now, if you take our market you take our property. If this market is taken away this property is valueless . . . if the property should be taken, then you should give us the constitutional right of fair compensation for it. . . . If the purpose . . . is to distribute this power to the largest number of people at the lowest rate, we offer you the means to do that . . .

"All we ask," concluded Mr. Willkie, "is that you do not destroy our property by invading our markets or by creating a board with the power to do that and thus destroy our ability to finance."

### Others who testified

Other utility men to testify were E. A. Yates, vice-president Commonwealth & Southern; P. S. Arkwright, president Georgia Power; James A. Longley, vice-president and chief engineer Tennessee Electric Power, and J. M. Barry, vice-president and general manager Alabama Power.

"The duplication of public service facilities," Henry I. Harriman, president of the Chamber of Commerce of the United States, advised, "is uneconomical and must ultimately result in added cost to consumers. The private properties that are now serving the public in the region of Muscle Shoals were built, and are now being operated, under public regulation. These would be destroyed by government competition. A wholly different relation to existing facilities was provided in legislation of New York creating the 'Power Authority of the State of New York.'"

As set forth in Mr. Harriman's statement, a comparison of the terms of the power authority act of New York and the pending bills which create federal power authority show a number of fundamental differences.

▼

## Soviets Complete Trial of Accused Engineers

Hopelessly enmeshed in false testimony, coercive actions by the Ogpu—the secret Soviet police—diplomatic implications and badly ordered Russian politics, the case of the British engineers accused of sabotage has dragged through weeks (ELECTRICAL WORLD, March 25, page 372). Various developments in the case of the six engineers accused included charges of third degree methods to exact "confessions," of plots to cripple Soviet power and industry in time of war and of frame-up to clear Soviet authorities of blame as internal economic conditions lead to dissensions in that country.

Soviet justice ground its temperamental and erratic way to a decision this week, bringing prison terms of three and two years for two of the British

engineers accused and expulsion from the Union for three others. One defendant was acquitted. Russians accused of complicity in the affair drew longer terms. W. H. MacDonald, who drew the two-year term, admitted his guilt. The remainder of the British stoutly defended their innocence.

The British government, in retaliation for the treatment accorded its subjects by Soviet authorities, has placed an import ban upon Russian goods heretofore entering the United Kingdom. The proclamation, signed by King George, affects about 80 per cent of Soviet-British trade and will be effective for a week. This would indicate that the authorities anticipate an early and successful reaction to the retaliatory action. It is Britain's contention that the convicted prisoners are innocent.

▼

## Bonbright Executives Change; No Policy Shift Foreseen

Although unofficially announced to be without significance so far as any change in policy of management is concerned, executive control of Bonbright & Company has recently been placed in new hands. Landon K. Thorne, formerly president, has been succeeded by Sidney A. Mitchell, until now a vice-president of Bonbright, and son of Sidney Z. Mitchell, former head of Electric Bond & Share, who recently resigned from all his utility and related interests. Fritz Lindh has been elected a vice-president to succeed Alfred L. Loomis.

Bonbright & Company, for years prominent in the promotion of electric light and power securities as distributors and underwriters of various issues and as regular financing agents for many large organizations, are reputed to have been instrumental in the financing of about 10 per cent of the entire industry.

▼

## Chicago Fair Lighting to Total 2,100 Kw. Outdoors

Electric lamps of every type—arc, incandescent and gaseous tubes—will be used in the outdoor illumination of the Century of Progress Exposition in Chicago; (ELECTRICAL WORLD, March 18, page 345). It is estimated that more than 2,100 kw. of electric energy will be required to light the thousands of light sources installed outdoors.

More than 15,000 incandescent lamps, ranging in size from 10 to 3,000 watts, will be used for the exterior illumination alone. It is possible only to guess the number that will be installed within the exposition buildings and concessions.

For building illumination a thousand 1,000-watt floodlights and 2,200 200-watt projectors will be used. Supplementing the effects of these lights, which will be directed only on the exteriors of buildings, a total of 375 combination street and floodlighting standards, 25 different designs of which have been prepared for the exposition, will brighten the roadways and smaller structures. One of the spectacular effects calls for a battery of 24 arc searchlights having a total light output of 1,920,000,000 candlepower.

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### Ground Lights for the Chicago Fair

*Westinghouse Electric & Manufacturing Company*

More than 2,000 "mushroom" luminaires, reminiscent of the French Colonial Exhibition in 1931, will line the walks of Chicago's Century of Progress Exposition. At 80-ft. intervals they will create a veritable shallow sea of colored lights—all colors of the rainbow. The mushroom will consist of an inverted translucent cone of micarta. The light transmitted by the refracting prisms to the grass and pathways will be clear white light, while that transmitted to the eye will be of low intensity in glowing colors.

▼

## G. E. Sales Billed Dropped 31% in First Quarter

Orders received by the General Electric Company for the first three months of 1933 amounted to $25,511,644, compared with $33,404,642 for the corresponding quarter last year, a decrease of 24 per cent. Sales billed for the first quarter of 1933 amounted to $26,101,001, compared with $37,876,399 for the same period of 1932, a decrease of 31 per cent. After payment of dividends on the special stock, profit available for dividends on the common stock was $2,195,050, compared with $4,508,668 for the first quarter of 1932. This is equivalent to 8 cents per share in 1933 and 16 cents in 1932 on the 28,845,927 shares outstanding in both periods.

Sales billed for the year 1932, not previously reported, decreased to $147,000,000, a decrease of 44 per cent from the preceding year. Profit available for dividends in 1932 was $14,400,000, which, after paying dividends on the special and common stock, left a deficit of $4,035,000, compared with a deficit of $7,768,000 for 1931.

▼

## Power to Regulate Accounts Sought by Utility Boards

Representatives of several of the more active public utility commissions of the country conferred last week with the District of Columbia Public Utilities Commission at Washington on plans to seek from the Interstate Commerce Commission a clear recognition of the rights of local commissions to regulate local aspects of accounts for depreciation of utility properties. The question of depreciation accounting, it was stated, has a vital relation to the ultimate charges made by utility corporations to their consumers.

Among those attending the confer-

ence were Major-Gen. Mason M. Patrick, chairman of the District commission; Milo R. Maltbie, chairman of the New York Public Service Commission; Mayland H. Morse, chairman of the New Hampshire Public Service Commission; David E. Lilienthal, a member of the Wisconsin Public Service Commission, and Frederick P. Gruenberg, a member of the Pennsylvania Public Service Commission. At the opening session the uniform system of telephone accounting prescribed by the Interstate Commerce Commission was attacked.

▼

## Portland Reinspection Reduced Hazards

Seriously endeavoring to institute a reinspection policy which would bring about the desired increase in safety factors and yet avoid offending those upon whom the regulations might be imposed, the Portland, Ore., inspection bureau reports a notably successful campaign and virtually complete public co-operation. According to J. F. Gray, deputy inspector for the city, from January 11, 1932, to April 1, 1933, 3,850 inspections were made within the inner fire district of the city, 528 written complaints or first notices of defective wiring were served against 111 buildings and only one building was passed without needing some repairs or adjustments. Written notice was not served where minor defects were encountered.

It is reported that less than ten second notices were necessary. One formal complaint or warrant for arrest was issued by the city attorney, but as repairs were made the warrant was not served. Work valued at $42,837 was created by this activity, which, according to Mr. Gray, eliminated many serious sources of potential hazard in Portland.

▼

### Utilities File Suit To Recover Taxes

Suits have been filed in the Federal District Court of Eastern South Carolina by the Duke Power Company and the Southern Public Utilities Company for the recovery of a total of $72,937 paid the South Carolina Tax Commission on power generated during February and March. The complainants hold that the tax of ½ mill on each kilowatt-hour of electricity generated and sold in the state is unconstitutional.

▼

### Patents Bring Tokyo Outbreak

Cradled in the rivalry between Japanese electrical apparatus manufacturers and the General Electric Company of Japan, subsidiary of the General Electric Company of the United States, with a patent application pending there, an outbreak occurred in Tokyo this week in which shops were threatened. The agitation was led by Lieut.-Gen. Nobutake Shioten, retired. A manifesto issued at the time indicated misunderstandings over the production of "Mazda" lamps and Japanese lamps to have been the chief element of contention, thinly disguised in an anti-Semitic plea induced by Hitlerite sympathy and publicity.

▼

## When Almost Anything Is Likely to Happen

**This has been inflation week. Congress, long in restraint, has at last unburdened its collective soul and performed appropriate genuflections to the great god of Escape. So tormented has the administration been and so strong is the pressure for jeopardizing the dollar that the lid was clamped down once more on gold exports, letting gleeful speculators sell the American dollar without much cause for caution. Stock and commodity markets active; bonds weak.**

**Inflation may come in several ways — reduction in the gold content of the dollar; remonetization of silver; fiat money, or large public works construction through the issuance of bonds. Left to its own inclinations, the administration would doubtless rely on its avowed public works program. Forced by Congress or an unfortunate turn of events in which further declines in trade or the haunting specter of the too-insistent muscling-in of the forgotten man who refuses longer to remain quiescent, other outcomes appear about to develop.**

**Last week included Good Friday, a holiday in many communities, yet energy production widened the gap between this year and last by but 0.3 per cent and is but 4.8 per cent below last year. Carloadings show a slight loss, but the decline is less than usual for the corresponding week of other years. Automobile output has risen for four successive weeks. General barometers of business show a continued and steep rise from the recent low point. One concludes that trade shows a definite vitality and impulse to recovery. That it will prove strong enough and fast enough to satisfy Washington is somewhat less than problematical.**

### Cities Service Net Income Down

In its annual report for 1932, made public this week, the Cities Service Company shows consolidated net earnings of $52,131,192, compared with $63,106,883 in 1931. Net income after depreciation and depletion charges, amortization of debt, interest and taxes and preferred stock dividends of subsidiaries, paid and accrued, etc., is shown in the consolidated income and surplus account as being $5,465,739. The company appropriated $18,367,449 for reserves from 1932 income; charges against reserves in the same period were $6,401,906. The balance of reserves for depletion and depreciation at the end of 1932 was $127,015,042. Total assets of the company on December 31 last were $1,288,104,832. Of the consolidated current assets of $87,489,014, cash holdings aggregated $28,365,371.

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### Swiss Output Off 1.7 Per Cent

Swiss output of hydro-electric energy in 1932 dropped off 1.15 per cent to 3,679.1 million kw.-hr., steam and internal combustion output nearly doubled to 10.8 million kw.-hr. The Swiss Federal Railways turned out about 69 per cent of its 1931 output and energy imported from other countries increased over 65 per cent to 9.6 million kw.-hr. The total of these sources was 3,768.1 million kw.-hr. or about 18 per cent less than in 1931. The figures were just issued by the Swiss Office Federal de l'Economical Electrique et l'Union de Centrales Suisses de l'Electricité.

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## Air-operated Breakers Reintroduced Abroad

Compressed-air-operated switchgear has been relied upon at the new Blackburn Meadows generating station of the Sheffield (England) Corporation to the virtual exclusion of all other types. Advantages cited are the low first cost and virtually instantaneous speed of operation. Compressed air is there used in place of solenoids or motors to close the circuit breakers. Breakers and related equipment have been erected on a framework with a central gangway, an arrangement which is said to have reduced floor space requirements and to have increased the accessibility of the assembly.

The operating mechanism consists essentially of a cylinder, mounted on the top plate of each breaker, the piston of which is connected to a rack permanently in mesh with a pinion. This pinion is mounted on a shaft which extends across all three phases and carries three bevel wheels, one of which is placed over the center line of each phase. These wheels are in turn connected through bevel gearing to two guide rods. The rotation of the guide rods therefore causes the beam supporting the moving contacts of the breakers to rise or fall and the breaker to be closed or opened. In the closed position a latching mechanism operates so that energization of the shunt trip coil releases the breaker contact beam, which falls downward under the assistance of torsional accelerating springs.

Compressed-air-operated breakers are not new to the electrical industry, but it is thought that their reintroduction in this form may show new advantages for the practice.

## Coming Meetings

**Missouri Association of Public Utilities**—St. Louis, Mo., April 27-28. N. R. Beagle, 101 West High Street, Jefferson City, Mo.

**American Welding Society**—New York, N. Y., April 27-28. M. M. Kelly, 29 West 39th St., New York.

**American Institute of Electrical Engineers**—District meeting, Schenectady, N. Y., May 10-12. Summer convention, Chicago, Ill., June 26-30. H. H. Henline, 33 West 39th St., New York.

**Electrochemical Society**—Montreal, Que., May 11-13. Colin G. Fink, Columbia University, New York.

**National Electrical Manufacturers Association**—Hot Springs, Va., May 22-26. A. W. Berresford, 570 Lexington Ave., New York.

**National Fire Protection Association**—Milwaukee, Wis., May 29-June 1. A. R. Small, 109 Leonard St., New York.

**Edison Electric Institute**—Chicago, Ill., June 5-8. B. F. Weadock, 420 Lexington Ave., New York.

**Canadian Electrical Association**—Lucerne-in-Quebec, June 14-16. B. C. Fairchild, Power Building, Montreal, Que.

**American Society of Mechanical Engineers**—Chicago, Ill., June 26-30. C. W. Rice, 29 West 39th St., New York.

**American Society for Testing Materials**—Chicago, Ill., June 26-30. C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

**Engineers' Day. Century of Progress Exposition**—Chicago, Ill., June 28. G. E. Pfisterer, 308 W. Washington St., Chicago.

▼

## Middle West Reorganization Progresses in Chicago

Negotiations between stockholders and unsecured creditors of the Middle West Utilities Company and the Chicago banks holding Middle West collateral to reconcile existing controversies have practically reached a successful conclusion, according to Charles S. Dewey, chairman of the Middle West Utilities Company noteholders' committee, speaking on behalf of all the groups. While the present virtual agreement does not take the form of an immediate reorganization of the company, it will dispose of questions on disputed collateral and other matters in controversy.

Full details of the plan will not be available until they have been placed in final form and submitted to the United States district court. No discussion has yet been broached as to the funds needed for reorganization, but the question will be taken up as soon as the agreement over present controversies has been approved by the court, the matter to be handled by a co-ordinating committee, comprising two representatives of the banks, two of the noteholders and one each for the preferred and common stock holders. Mr. Dewey said the banks had displayed "a broad-minded attitude, showing they were considering the interests of the public and Middle West investors as much as their own."

Plans for the reorganization of the United Public Service Company, a subsidiary of the Middle West Utilities Company, have taken more definite form. An order for a court hearing on the reorganization has been signed by Federal Judge Walter C. Lindley and the hearing has been set for May 15. The plan, involving the United Public Service Company, its principal subsidiary, United Public Utilities Company, and other subsidiary and affiliated companies, provides for the merging of United Public Service, United Public Utilities, Southern United Gas and Southern United Ice into one unit, to be known as United Public Utilities Company. This new company will have three classes of securities, the present first lien bond issues of United Public Utilities, approximately $2,500,000 of new preferred stock and 300,000 shares of new common, probably of no par value.

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# Illinois Launches State-Wide Inquiry

ISSUING citations against the 27 largest electric utilities of the state, the Illinois Commerce Commission has commanded representatives of these organizations to appear before the commission and show why their respective rates for service should not be reduced at once. This action is the first step toward the fulfilling of the announcement made by B. F. Lindheimer, chairman, that "the commission will shortly institute the most comprehensive and thorough investigation of utility rates that has ever been had in the state of Illinois."

The state has, for the purposes of the investigation, been divided into northern and southern groups of companies. The former are to appear before the commission on April 27 in Chicago. The latter are called for a meeting in Springfield, May 3. The companies involved serve 1,443 municipalities and about 99.8 per cent of the users of electrical energy in the state.

### Lower costs to be considered

"The commission is cognizant," the citations said, "of the general economic conditions as they affect the customers' ability to pay charges for electric service, and has conducted investigations concerning the effect of such conditions on the cost of constructing and operating electric public utility properties in Illinois.

"As a result of such investigations and analyses thereof it is found that the cost of constructing and operating such properties is lower than costs which prevailed a few years ago.

"These matters constitute a good reason why the rates should be investigated, and the situation is one in which your company should reasonably be required to demonstrate that its present rates are not excessive and should not be reduced."

### "Inflated" valuations a target

"The commission expects to be absolutely fair in the determination of property value," said Chairman Lindheimer, "but under no circumstances will it consent to include in such value any property excepting that which is used and useful in rendering the service of the utility.

"Furthermore, an honest attempt will be made to fix the value of these properties as it is today rather than upon the inflated valuations which prevailed some years back. The commission will also present the best data obtainable in respect to the expense of operating the utilities. Items of alleged expense which in the judgment of the commission are not proper and reasonable will not be allowed to continue in the rate base of the companies.

### Speed is promised

"These hearings will be so conducted as to avoid as far as possible the protracted trials and hearings which seem to have been the rule in the past. Our engineering and accounting staff has been instructed to prepare and have ready for immediate introduction into the record the best obtainable evidence concerning the value of the property of the utilities and their reasonable expenses of operation."

▼

## Oregon Commissioner Seeks Popular Vote on Regulation

Dissatisfied with the mangled relic that was once his carefully prepared and warmly sponsored reform regulatory bill for the state (ELECTRICAL WORLD, March 25, page 372), Oregon's one-man Public Utilities Commission now seeks the enactment of a more stringent regulatory law by direct vote of the people. Commissioner Charles M. Thomas contends the regulatory measure he sponsored in the Legislature to have been so emasculated by amendment as to leave the situation practically in *status quo*, or, in other words, as to leave the commissioner without authority and without machinery to bring about effective utility regulation in the state.

Mr. Thomas contends that the people's remedy rests either in an effective regulatory law or in public ownership. The principal cause of what he has called the failure of public regulation to date is cited as the maze of court procedure now open to utility companies in appeals from commission orders. Utilities have taken advantage of the courts and the delays

open to them in court procedures with the effect of defeating public regulation, Mr. Thomas claims.

▼

## $26,000,000 Financing by Boston Edison Company

To meet a maturity of $10,000,000 in 4½ per cent notes due May 2 and to retire bank loans of $16,000,000 due the same date, the Edison Electric Illuminating Company of Boston this week successfully entered the security market with a two-element offering of short-term notes totaling $26,000,000. The notes offered consisted of $16,000,000 in 5 per cent coupon notes due April 15, 1936, and $10,000,000 of non-interest bearing seven-month discount notes. This offering constitutes the first public financing by utilities since early in February, exceeds the total of all previous utility issues since the first of the year and is the largest single piece of financing, other than by the government, in 1933.

The notes were offered as direct unsecured obligations of the company, which has, however, filed a protective agreement assuring that no further mortgages will be issued against existing property unless the notes are equally secured or retirement provided for.

Boston Edison has the following maturities in notes subsequent to the present financing: (new issue) due October 16, 1933, discount notes, $10,000,000; two-year notes due July 16, 1934, $25,000,000; three-year notes due May 2, 1935, $20,000,000, and (new issue) three-year notes due April 15, 1936, $16,000,000.

The offering was made, on the coupon notes, at 99 per cent and accrued interest to yield about 5.36 per cent; the discount notes at 3½ per cent bank discount.

▼

## Pacific G. & E. Customers Have Fared Well, Says Head

Customers of Pacific Gas & Electric Company are in a more favored position than those of many other utilities, President A. F. Hockenbeamer told stockholders at the annual meeting of his company.

In support of this contention he cited:

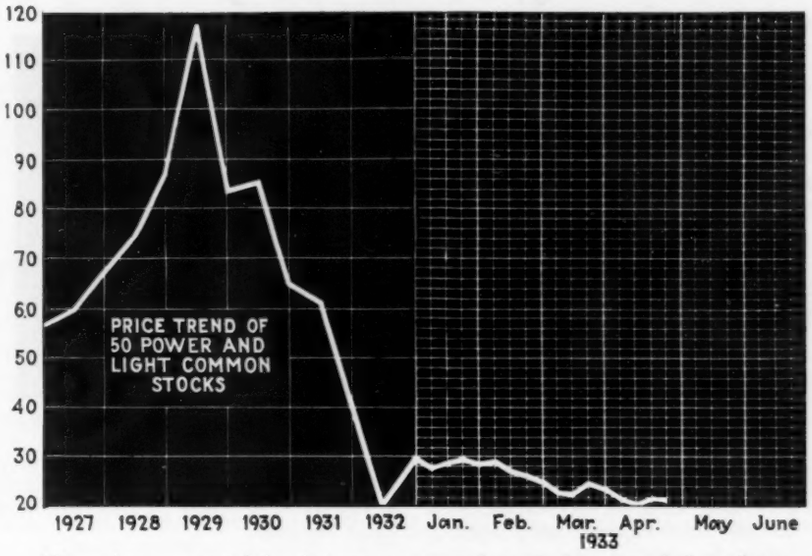
1. In the last ten years the average cost per kilowatt-hour of electric energy to commercial and residential customers, constituting 90 per cent of all the organization's electric customers, has been reduced from 7.02 cents in 1921 to 4.23 cents in 1932. This is a reduction of 40 per cent. In each of the last ten years some reduction is shown.

2. In 1932 the company's average electric rate to domestic consumers was 28 per cent below the national average.

3. The total savings to both gas and electric customers during the past ten years amount to somewhere between $25,000,000 and $30,000,000 per annum, or approximately $5,000,000 in excess of a year's dividends on the entire outstanding capital stocks of the company.

4. According to the State Railroad Commission during the three years to June 30, 1932, covering almost the entire period of the business depression, rate reductions in California aggregating $19,642,457 had been made. Of this amount $11,000,000 is credited to Pacific Gas & Electric.

## Stocks Weak Before Inflation Rally




**Wavering uncertainly between upward and downward impulses, security markets failed to develop definite trends until late in the week. "Electrical World" stock index dropped from 21.8 to 21.3.**

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## A. E. Peirce Utility Sifted at Federal Trade Hearing

Testimony placed before the Federal Trade Commission last week by Robert J. Ryder, an examiner, indicated that the Central Public Service Corporation of Chicago, of the A. E. Peirce group of public utilities, sold capital stock from 1929 to 1931 to realize cash to pay dividends which earnings did not provide. The Central Public Service Corporation served 725 communities in 1931, having operating properties in twenty states and seven foreign countries. Mr. Ryder presented summaries of accounts to show that some 50 per cent or more of its financing was obtained through sales to the public of its no-par value class A stock. This stock yielded gross proceeds of $78,998,000, of which $73,835,000 was received in 1929, 1930 and 1931, he stated.

The company got into difficulties in meeting its maturing obligations late in 1932 and early 1933 and in the course of attempts to solve the problem it reorganized. At the time of reorganization the company wrote down the value of its investments by $52,948,000. It wrote down other accounts also, bringing the total of the write-downs to $73,514,000. This change would have shown a deficit of about $59,669,000 for the company as of October 31, 1932, but Mr. Ryder said the accounts were revised so that a surplus of more than $8,000,000 was shown instead of a deficit. Nevertheless, the company shortly afterward went into receivership.

Robert E. Healy, chief counsel for the commission, introduced in the record letters alleging that improper methods had been used in selling some of the company's stock and that investors had lost money because of unkept promises.

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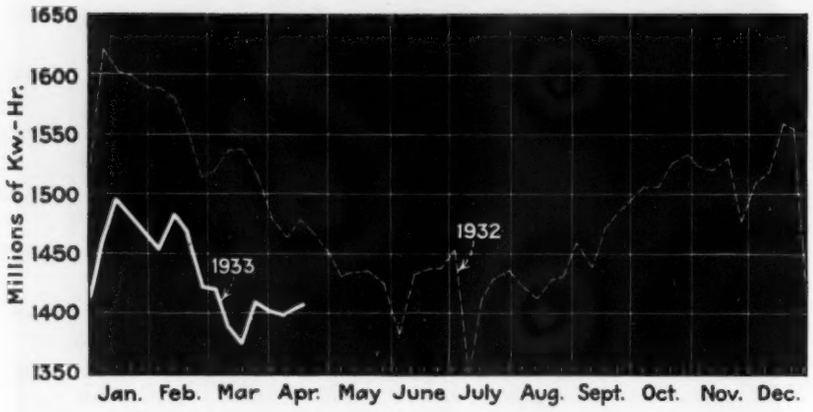
## Niagara Hudson Earned $1.07 on Common in 1932

(Year ended December 31)

| | | |
|---|---|---|
| **Earnings** | | |
| Gross operating revenue | $71,806,482 | 7.3% below 1931 |
| Net operating revenue | $32,989,981 | 9.4 per cent below 1931 |
| Balance available for common stock | $9,378,343 | 30.1% below 1931 |
| Earnings per share | $1.07 | in 1931 $1.53 |
| Dividends paid on common stock | $1.19 | |
| Charge to surplus to pay common dividends | $1,093,535 | |
| **Balance Sheet** | | Compared with 1931, per Cent |
| Plant and property | $580,093,872 | —17.7 |
| Investments in common stocks of other companies at cost together with sundry investments* | $42,937,020 | + 3.1 |
| Current assets | $28,173,327 | —16.9 |
| Current liabilities | $26,727,991 | —14.3 |
| Funded debt | $225,216,550 | — 4.7 |
| Reserves | $33,167,356 | — 0.5 |
| Surpluses | $53,737,722 | — 3.3 |

* Approximate marke value at Dec. 31, 1932 $22,250,000

## Energy Output Larger




Rising three-fourths of a per cent from the preceding figure, in contrast with the normal downward trend in spring, production by electric light and power stations during the week ended April 15 amounted to 1,409,603,000 kw.-hr., the Edison Electric Institute announces. Compared with operations a year ago this indicates a decrease of 4.8 per cent, or nearly the same as in the week before, thus holding the gains registered in the recent past.

Regional percentages show moderate recessions, compared with 1932, except on the Pacific Coast. In no case, however, did these losses outweigh the gains in the week of April 16 last year in the same regions.

*Weekly Output, Millions of Kw.-Hr.*

| Week ended | 1933 | 1932 | 1931 | 1930 |
|---|---|---|---|---|
| April 15 | 1,410 | 1,481 | 1,641 | 1,733 |
| April 8 | 1,399 | 1,465 | 1,647 | 1,715 |
| April 1 | 1,402 | 1,480 | 1,680 | 1,708 |
| March 25 | 1,410 | 1,515 | 1,689 | 1,723 |
| March 18 | 1,375 | 1,538 | 1,682 | 1,722 |

*Per Cent Change from Previous Year*

| Region | Week Ended Apr. 15 | Apr. 8 | Apr. 1 |
|---|---|---|---|
| Atlantic Seaboard | —4.9 | —2.7 | —4.6 |
| New England alone | —6.0 | —3.8 | —7.2 |
| Central industrial | —6.3 | —5.7 | —8.1 |
| Pacific Coast | —6.6 | —6.8 | —5.7 |
| United States | —4.8 | —4.5 | —5.3 |

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## Pinchot Asks Utility Curb; Seeks to Oust Dr. King

Demand for the enactment of adequate utilities' regulation legislation and for the confirmation by the state Senate of four of his appointees to the Public Service Commission was made this week by Governor Pinchot in a special message delivered personally to the Pennsylvania Senate. Governor Pinchot also asked that the nomination of Dr. Clyde L. King, chairman of the Public Service Commission, be returned to him that he might substitute for it the nomination of "a man of whose devotion to the public interest there can be no question." Referring to Commissioners Woodruff, Gruenberg, Stahlnecker and Goodnough as "honest, able, sound and loyal to the people" and deserving of confirmation in the public interest, Governor Pinchot declared that it is with the deepest and most genuine regret that he discussed Dr. King.

The break between Dr. King and the Governor came several weeks ago after the reorganization of the special committee of the Senate for the investigation of the Public Service Commission, which Senator McClure was elected to head in place of Senator William S. Rial (ELECTRICAL WORLD, March 18, page 338). Dr. King refused to accede to the Governor's request that he tell the investigating committee that he believed a continuation of the investigation was necessary and on the contrary made a statement that the personnel of the commission and the office force was beyond reproach. Shortly after the resignation of Oliver K. Eaton, chief counsel of the commission, also attacked by Dr. King, the Governor asked the Senate to return his nomination of Dr. King, which the Senate declined to do (ELECTRICAL WORLD, March 25, page 371).

### Pinchot bill provisions

At the hearing before the Senate the Pinchot utilities regulation bill was introduced. The Governor made a comparison between his measure and that sponsored by Senator McClure. The administration bill gives fullest power possible under interstate conditions to the commission over affiliated interest relationships; provides that no increase in rates shall go into effect until approved by the commission; limits charters and franchises to 50 years and gives the commission full power to protect the public by forbidding the issuance of securities by utilities without the prior approval of the commission. The McClure bill, passed by the Senate and embodying recommendations of the Senate utilities investigating committee and Public Service Commission, omits many provisions contained in his measure, Governor Pinchot stated.

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## Portugal Has Many Small, and Few Large, Stations

Portugal, with about 80 per cent of its generating capacity and output in publicly owned generating plants, has nearly ten times as many stations under 100 kw. as it has over 1,000 kw. An increase of output from publicly owned plants during 1931 of 7.32 per cent was shown, according to recent government reports. On the other hand, there was a reduction in output of private plants which reduced the total increase for the year to about 3 per cent.

Lisbon and Oporto, the two major load centers, took about 50 per cent of the country's output. These two cities showed a consumption per capita of 136 and 160 kw.-hr. respectively, compared with 44.4 kw.-hr. for the whole country. Lighting and traction consumption, which collectively consumed about 59 per cent of the output in 1928, dropped to 50 per cent (about equally divided) in 1931, but energy for power and electrochemical purposes increased from 41 per cent to 50 per cent.

Out of the total of 1,687 miles of overhead and underground circuits (85 per cent overhead), only 22 per cent operate at 30 kv. and over, most of the circuits being energized at 5,000 to 7,000 volts.

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## Ontario Hydro Board Reports Reduced Output

According to the 25th annual report of the Hydro-Electric Power Commission of Ontario, covering the year 1932, the demand for power on its system last year was substantially the same as that of 1931. Energy use in Ontario declined 1.2 per cent last year as against 15 per cent in 1931.

During the fiscal year 1931-32 there were constructed, or under construction, some 526 miles of primary transmission line in the rural power districts of Ontario. This mileage was less than half the mileage constructed each year for the past five or six years. Electrical service was given to 3,933 additional rural consumers and the capital expenditures approved for rural construction work was $1,123,741.

The total capital investment in all power properties, railways, office and service buildings, construction plant and inventories, etc., administered by the commission amounts to $273,228,754, as at October 31, 1932. The total reserves of the commission aggregate $66,145,486, an increase of $3,741,074 over 1931.

## Refrigerator Makers Active in Small-Unit Production

Whether customer sales have increased sharply or not, distributors are taking refrigerators in such volumes as to permit manufacturers to speed up production. Kelvinator Corporation reports orders 10 per cent increased over last year. Norge has shipped 24 carloads valued at $250,000 to its Philadelphia distributors. Frigidaire (ELECTRICAL WORLD, April 8, page 440) and Westinghouse (April 15, page 472) are on increased schedules. Automatic Washer Company, outside the refrigerator group, has sent 26 carloads of washers to its Chicago distributor.

Factory forces in all General Electric Company refrigerator plants have been increased from 50 to 100 per cent to meet current sales, while shipments from the production line are now at the rate of one trainload a day. According to P. B. Zimmerman, manager of General Electric's refrigeration department, the "Shipments . . . represent actual sales."

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## 1,208,000-Hp. Development of the St. Maurice Possible

Far from having reached their ultimate development the hydro-electric resources of the province of Quebec offer potential power for the needs of the province in almost unlimited quantities, C. R. Lindsey told the Engineering Institute of Canada last week. A total tentative installed capacity of 1,208,000 hp. can be economically developed and transmitted to industrial centers from a 78-mile section of the St. Maurice River alone, Mr. Lindsey revealed.

For several years, in company with S. Svenningson, chief engineer of the institute, Mr. Lindsey has been surveying the possibilities of hydro developments along the St. Maurice at nineteen locations comprising 33 possible heads. In the study of data 51 schemes were given consideration and comparative estimates made, and as a result plans for six developments were submitted to the government and given approval.

The St. Maurice is the second largest tributary of the St. Lawrence the watershed of which is wholly within the province of Quebec. The possibilities of diverting the flow of the St. Maurice into the Vermillion River was also dealt with by Mr. Lindsey, who cited among advantages the smaller flow to be taken care of during construction.

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## Seattle Seeks Federal Aid for Ruby Dam Construction

With financing of the Seattle Light Department's Diablo power plant still a perplexing problem, the City Council, on recommendation of Superintendent J. D. Ross, is resuming consideration of development plans for the long-considered Ruby Dam project, 7 miles farther up the Skagit River. This $18,500,000 hydro-electric project on the British Columbia-Washington boundary calls for construction over a five-year period of a power and flood control dam on the Skagit River near the international boundary, giving employment to 15,000 persons, this summer.

The project would be the most northerly in the city's large hydro-electric development on the Skagit River and would involve not only the erection of the Ruby Dam, but also the clearing of the 40-mile-long Ruby reservoir site extending into British Columbia. Assistance of the federal government's Reconstruction Finance Corporation will be sought in the financing. The city would build the dam and immediately issue $18,500,000 in bonds in series running 30 years, redemption to start in the eleventh year.

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## Taunton Plant Addition May Cost Only $50 a Kw.

Active work has begun on the construction for the Taunton (Mass.) municipal electric plant of a 7,500-kw. addition. According to Arthur L. Nelson Engineers this will be done at an estimated cost of under $50 per kilowatt, yet embracing equipment of unusually high efficiency for an installation of this rating. To date orders have been placed for a 100,000-lb.-per-hour steam boiler to operate at 450 lb. gage pressure and 725 deg. F. total steam temperature with superheater and water walls, a 7,500-kw., three-phase, 60-cycle, 13,800-volt Westinghouse turbo-generator of the extraction type, with 8,500-sq.ft. surface condenser and miscellaneous auxiliaries, including a Ljungstrom air preheater, fans, pumps and oil-burning equipment. The guaranteed over-all efficiency of the boiler, superheater, air preheater and furnace at full load is 84.1 per cent, and the turbine water rate at full load at the throttle is 9.4 lb. per kilowatt-hour.

Prior to the decision to install additional capacity an engineering analysis was made of plant and system requirements. An important factor existed in the contemplated sale of industrial steam to manufacturing plants in the Taunton district, several of which are in the immediate vicinity of the station. The plant has a 5,000-kw. interconnection with the Montaup Electric Company's transmission system and a present rating of about 8,000 kw.

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## Major New Construction This Week

**Machine drives, motors, controls, transformers, hoists and conveyors will be purchased for parts and assembly plant of Virginia Airship Company, Inc., Richmond, Va. Cost about $350,000.**

**General electrical equipment for expansion of Tuscora Brewing Company, Canton, Ohio. Cost over $200,000.**

**Heavy-duty motors, pumping machinery, transformers and conveyors will be purchased for new soy bean processing and oil mill at Norfolk, Va., of Allied Mills, Inc., Chicago, Ill. A $450,000 project.**

**General electrical equipment for new plant of J. J. Murphy Brewing Company, Trenton, N. J. A $400,000 project.**

**Scottsbluff, Neb., plans Diesel-engine power plant; 25-year franchise granted. Cost over $100,000. Robert Fulton, Lincoln, Neb., consulting engineer.**

**General electrical equipment will be installed in Orange, N. J., brewery of J. F. Trommer, Inc., Brooklyn, N. Y. Cost about $400,000.**

**Burlington, Kan., arranging fund of $118,000 for city-owned electric plant.**

## Energy for the City of Muscle Shoals

For years living in the shadow of the great Wilson Dam at Muscle Shoals, Ala., without having any electrical energy available to them, residents of the newly formed city of Muscle Shoals have decided to erect a distributing plant and 20 miles of supply lines.

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## New York Metal Prices

| | April 11, 1933 Cents per Pound | April 18, 1933 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 5.25 | 5.37½ |
| Lead, Am. S. & R. price | 3.25 | 3.25 |
| Antimony | 5.70 | 5.60 |
| Nickel ingot | 35.00 | 35.00 |
| Zinc, spot | 3.45 | 3.50 |
| Tin, Straits | 35.50 | 25.75 |
| Aluminum, 99 per cent. | 23.30 | 23.30 |

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## Delinquent Electrical Accounts

(National Electrical Credit Association)

**Number of Accounts Reported**

| Division | March 1932 | March 1933 | Per Cent Inc. or Dec. | Three Months 1932 | Three Months 1933 | Per Cent Inc. or Dec. |
|---|---|---|---|---|---|---|
| New York | 287 | 180 | —37.3 | 713 | 525 | —26.4 |
| Middle and Southern Atlantic | 155 | 61 | —60.6 | 369 | 197 | —48.6 |
| New England | 145 | 54 | —62.8 | 374 | 178 | —52.4 |
| Central | 628 | 225 | —64.2 | 1,608 | 795 | —50.6 |
| Total | 1,215 | 520 | —57.2 | 3,064 | 1,695 | —44.7 |

**Total Amounts Reported**

| | | | | | | |
|---|---|---|---|---|---|---|
| New York | $29,632 | $10,548 | —64.4 | $75,008 | $34,205 | —54.4 |
| Middle and Southern Atlantic | 9,212 | 3,911 | —57.5 | 34,213 | 12,215 | —64.3 |
| New England | 11,504 | 3,294 | —71.3 | 31,592 | 11,548 | —63.4 |
| Central | 43,272 | 13,412 | —69 | 129,004 | 53,600 | —58.5 |
| Total | $93,620 | $31,165 | —66.7 | $269,817 | $111,568 | —58.7 |

### Bureau of Standards Revision

Using improved apparatus, physicists of the U. S. Bureau of Standards have made new determinations of the values of the ampere and ohm. It is reported that according to their findings, one Bureau of Standards International Ampere equals one 0.99994 Absolute Ampere. One Bureau of Standards International Ohm equals 1.000452 Absolute Ohms.

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### Alabama Rules on Tree Trimming

Electric power companies are under no obligation to "remove every dead tree standing near enough to their lines for its branches to come in contact with a line in falling," according to a ruling of the Alabama Supreme Court. This tribunal reversed the action of a lower court which awarded judgment to a farmer whose mule came in contact with the branches of a tree fallen across an Alabama Power Company line. The tree was just off the company's right-of-way.

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### Hydro Commission for No. Carolina?

Following developments in the Muscle Shoals situation in Congress, North Carolina has taken under consideration the formation of a state Hydro-Electric Commission to consist of five members empowered to issue bonds and purchase lands by condemnation or other proceedings for the establishment of state-owned power plants. The enabling bill is now under discussion by the state legislature.

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### French Output Declines in 1932

Based on the production figures of 50 principal electric power stations in France, representing approximately 64 per cent of the total French production of electrical energy, it is estimated that energy output amounted to 8,902,951,954 kw.-hr. in 1932, as compared with 9,385,964,458 kw.-hr. in 1931, a decrease of 5.14 per cent.

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### Shanghai Power Protected

Though the Shanghai tael has been abolished as a monetary unit and the Chinese silver dollar substituted for it, there will be no adverse effect upon the fortunes of Shanghai Power Company, a part of the American & Foreign Power system. According to C. E. Calder, president of the latter organization, "the franchise of the Shanghai Power Co., granted August 8, 1929, provides that should the tael be abolished, either by official decree or by common usage, the company will have the right to restate its rates in terms of the new currency and in such manner as to maintain its business on as sound a financial basis as prevailed prior to the change. Under such conditions the company's revenues are maintained and the holders of the company's securities fully protected."

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### Ohio Dividends Protested

Charging officials of three telephone companies operating in the state to have approved payment of unearned dividends, the Public Utilities Commission of Ohio has cited them to show cause why they should not be ordered to restore their capital structures. This is said to be the first time in the history of the commission that it acted upon its own initiative to halt the payment of "illegal" dividends.

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### Michigan Service Expanded

Electric service from central stations was extended to 31 additional Michigan communities in 1932 according to a compilation made by the state Utilities Information Bureau. It was also furnished to more than 2,250 additional farms. These extentions increased the number of Michigan communities with electric service to a total of 1,328 and the number of Michigan farms to more than 36,500.

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### Competition for El Paso?

An electric plant to be built for the specific purpose of supplying El Paso, Tex., hotels and theaters is being discussed by local interests. Plans have been drawn for a $180,000 project. Opposition by the El Paso Electric Company, which holds the electric franchise in the city, is anticipated.

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### Illinois Utility Merger Opposed

Alleging present property values of the Illinois Power Company to be approximately 40 per cent less than the book value, the city of Springfield, which competes with the Illinois Power in furnishing electric light and power service, has filed a motion with the Illinois Commerce Commission, in the case which is pending affecting the proposed consolidation of properties of that company with the Central Illinois Light Company (ELECTRICAL WORLD, March 18, page 344). The petition asks that the commission investigate actual values before approving issuance of new securities by either Central Illinois Light or Illinois Power.

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### Cutler-Hammer Reports

Shipments of Cutler-Hammer, Inc., in the first quarter amounted to $585,480, as against $689,010 in the previous quarter and $844,192 in the first quarter of 1932.

## As to Rates——

● Duke Power Company announces schedules, effective May 1, which will presumably save large industrial customers in North and South Carolina about $528,000 a year. Subject to commission approvals.

● Though the Illinois Commerce Commission is investigating the rates of the three utilities serving the Chicago area, Commonwealth Edison, Peoples Gas Light & Coke and Public Service of Northern Illinois, it has been stated that no immediate cuts are to be anticipated pending a determination of the whole rate structure.

● Under the direction of the Washington state Department of Public Works a program for the reduction of electric rates has been undertaken. C. K. Murray, newly-appointed director of the department, has indicated his intention to swing energetically into action to reduce charges. First on the list comes the Puget Sound Power & Light Company, whose wholesale rates are asserted to be "unreasonably" high.

● Contending that present rates are not adequate, Louisville Gas & Electric Company officials are reported to have rejected the recommendations of engineers retained by the city (ELECTRICAL WORLD, April 8, page 486). City officials talk of recourse to the federal courts.

● Savings of $240,000 a year to domestic and commercial consumers of electricity in Staten Island are contemplated under a revised rate schedule filed with the New York Public Service Commission by the Staten Island Edison Corporation. The rate structure would be simplified by reducing the number of service classifications from thirteen to eight.

● Rejecting rate adjustment offers of the Public Service Company of Indiana, the Mayor and City Council of Connersville, Ind., have asked general rate cuts to be accompanied by a revaluation of the utility company's property used to supply Connersville.

#### Reversion to kerosene

Starting late in March with concerted action by 150 customers of the Windham Electric Company, Trumbull County, Ohio, has witnessed a widening revolt by rural consumers who ordered electric service cut off and reverted to kerosene lamps and candles as a protest against the rates in effect. Several hundred residents of Hubbard Township, customers of Ohio Edison Company, having asked and allegedly been refused rate reductions, are reported to have joined the "strike."

Latest reports indicate that energy users in thirteen of the twenty-five townships of Trumbull County have organized to demand rate cuts. Nine of the thirteen are making their demands upon the Ohio Edison Co., two upon

the Ohio Public Service Co. and two on the Windham Electric Co. The latter buys and resells current from Ohio Public Service.

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## 150,000 Kw. Tie-Line in New York Nears Use

With the capitulation of the Yonkers City Council the last obstacle in the way of the completion of the 110/132 kv.-150,000 kw. tie-line between the New York Edison and Niagara-Hudson systems has been removed. According to William McCabe, Yonkers City Clerk, permission to bridge the 3,000 ft. gap was yielded in return for a reduction in the rates paid by the municipality of $50,000 in street lighting charges and a yearly saving of $120,000 for consumers in that city.

Designed to be "lightning-proof" the line (described by J. D. Whittemore, then executive engineer of the New York Power & Light Corporation, ELECTRICAL WORLD, July 18, 1931, page 100) offers one of the notable inter-connections of the country. Upstate power, largely from the Sacandaga project will be available for New York City purposes. At other times the New York Edison system will send energy to the Niagara-Hudson system.

Delayed by request of the New York Power Authority (ELECTRICAL WORLD, October 17, 1931, page 674 and November 14, page 851), by the protests of Westchester County property owners who feared desecration of the countryside (January 16, 1932, page 128 and April 30, page 755), as well as by the difficulty in securing permission to cross Palmer Avenue, Yonkers, the construction period has been a stormy one. Completion is looked for within 30 days. Fuel savings as high as 500,000 tons a year have been discussed by engineers as resulting from this interconnection.

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## Range Rentals in Michigan Expand Use at Rapid Rate

Just as an example of what can be done, and without bias as to who does it, consider the case of South Haven, Mich., a town of 5,000, with 1,800 meters, largely a summer resort community. On one winter day this town added a third as many ranges, 31, to the local supply lines as were so placed in the past 23 years. Twice as many in one day as were sold in the whole of last year. To phrase it differently, 52 ranges were added in four days, or 60 per cent of those installed there since 1910. Rentals did it.

South Haven has a municipal plant. It never sold ranges, or other merchandise, that was up to the local dealers—three of them. The plan so successfully adopted, in which the city plant and dealers co-operated, was to allow each dealer to act as rental agent at a fee of $7.50 a range; each dealer to get the installation job, materials furnished by the city, with an allowance of $15 for labor. Ranges, $72 grade, rent for $1.50 a month, installation free. Option to purchase with allowance for payments made. After 48 months range becomes property of the renter.

It happens that in this campaign the city secured no customers for ranges. Dealers got them all. The city stood to make $1,300 in the first year on the first day's business at an outlay of, roughly, $3,000.

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### Sterilization of Water in France

Electrical sterilization of water in installations capable of treating 22,000,000 gal. a day have been made in France. According to M. P. Otto, president of the Société Havraise d'Energie Electrique, an installation capable of treating 66,000,000 gal. a day for supplying the city of Paris with water from the Marne River is now being made after use on a smaller scale for ten years. The system used involves eight batteries of ozonizers supplied with electrical energy at 500 cycles per second from a special substation.

## Research Advances Sound Reproduction

Controlled by no less an authority on music than Leopold Stokowski, the ceno-orchestra, developed by the Bell Telephone Laboratories, was demonstrated before a critical audience at the Academy of Music in Philadelphia last week. Involved is a notable advance in the art of sound transmission by wire. Essentially the development is that whereby with proper co-ordination the audience is given a sense of location of the various instruments of a remote orchestra and wherein loudspeakers and microphones of unusual characteristics are used to give distortionless, controlled amplification.

Three loudspeakers strategically placed on the stage and connected to many microphones near the distant orchestra enabled Dr. Stokowski to secure unprecedented pianissimi and rushing crescendos. Three accomplishments are recognized; the first is what is called "auditory perspective"—creating the impression of an invisible orchestra grouped as it actually is at some distant point. The second is the faithful reproduction of the music from the lowest to the highest pitch. And the third is range of volume from a barely audible whisper to a din that no ear can endure.

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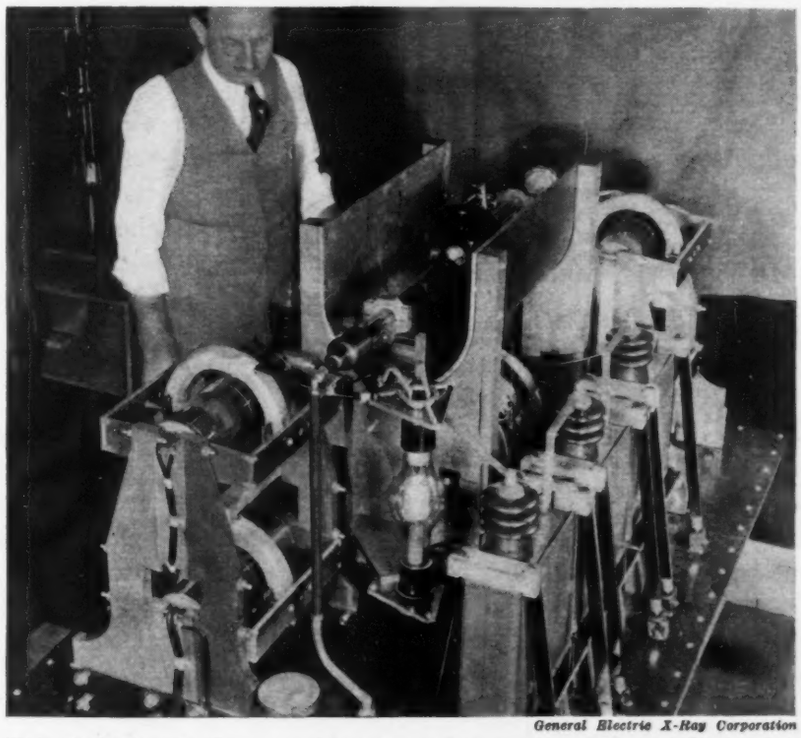
## To Examine 75 Miles of Welds



*General Electric X-Ray Corporation*

**This 300,000-volt X-ray equipment represents the most recently developed apparatus for the examination of welded steel. Encased in a permanent, portable housing and immersed in oil, the high-voltage system shown will be used at Hoover Dam to demonstrate the welding of penstocks ("Electrical World," April 15, page 467).**

# EDITORIALS

L.W.W.MORROW
*Editor*

## Deathblow to the St. Lawrence?

EXPORT of hydro-electric power to the United States was authorized by the legislative assembly of Quebec recently. In explaining the legislation Premier L. A. Taschereau said one of the chief reasons for it was to "deal a deathblow to the St. Lawrence waterways development project." The arguments indicated that Quebec had about 300,000 hp. of hydro power now available for sale to the United States and this could be sold at a price competitive with St. Lawrence power and without the necessity for the expenditure of enormous sums for the St. Lawrence project.

Negotiations are being opened with American utility interests to find out the market possibilities for Quebec power in New England and in New York State. It is apparent that Quebec will offer bargain prices if this will sell sufficient power to stop the St. Lawrence waterway plan. Unfortunately the American power market is at a low stage now and the practical effect of the Quebec offer will be a renewed boiling of the political pots at Albany and Ottawa.

## Free appliances add to rentals

NEWS comes from British Columbia and Ontario that ranges and water heaters are given free to domestic customers. The reason is excess power and the fact that this plan is profitable on the basis of returns from energy sales. News comes also of another range-rental scheme under the auspices of the municipal plant at South Haven, Mich., where three dealers had 52 range-rental applications in the first week. What do these straws indicate?

They show that an inducement rate plus a non-traditional merchandising idea unite to get business under present conditions. They show that the utility, the manufacturer and the dealer can each make a profit despite a violation of the older conceptions of merchandising. We venture to predict that other communities will awaken also and that news items of this character will grow in number as the days pass by.

## Allies of industrial modernization

AT NO period since the world war has the utility power sales engineer been in a position to serve industrial customers so effectively as today. In striving to retain power business in the face of low industrial demands and the competition of isolated plant machinery makers, the central-station engineer's customer contacts afford a valuable entrée to discuss modernization both of plant and methods.

Many industrialists still do not realize the economic possibilities of rehabilitation in their establishments, even in relation to subnormal volumes of business. Too many executives have turned away from such betterment work because they assume it necessitates changing over entire plants to the most modern methods. In thousands of cases rehabilitation can be done on a step-by-step basis proportioned to the amount of production now being handled or immediately in sight.

The power sales engineer's intimate relations with industry should be capitalized in support of justified modernization, and indeed this is already being done in progressive companies. His understanding of the value of electric power, heating and special lighting as aids to greater economy in particular processing should point the way toward the investment of economically warranted dollars in improved apparatus and methods. The industrialist looks upon the utility engineer of the right sort as an unprejudiced student of his production activities. In some cases modernization will

mean the sale of more power than before, and in others less. The power industry has viewed these problems in a broad way for a long time and has not allowed its own interest in them to encourage waste of electricity. It has constantly been allied with the pursuit of industrial efficiency and can be counted upon to co-operate with the customer and his engineering consultants toward profitable modernization, whether by piecemeal or general program, in the months ahead.

## Positrons and negatrons

MODERN physics has become so involved in its maze of conflicts of theories and experiment that most physicists are themselves confused and often discouraged. It is said that only some fifteen or twenty of them are able to follow the pure mathematical speculations of Einstein, de Broglie, Dirac and others, which have avowedly taken on a metaphysical rather than a physical character. A prominent professor of physics recently resigned because he could not follow contemporary physical literature and discussion. Electrical engineers, therefore, need feel no reproach if some of the latest manipulations of electrical theory suggest phenomena and spheres of their application which seem hopelessly removed from daily experience. Let them be content. This old world's daily round is not affected by any of it. Kirchoff's and Faraday's laws are not threatened, nor even those of Newton as related to mundane nature, and as yet not a formula of applied science has had to be modified.

But when it comes to experiment and something that can be seen, we take heart again, especially if it tells us something of the basic nature of electricity. The latest is the announcement by C. D. Anderson of the California Institute of Technology of the discovery of the "positron," which is a charged particle of about the same mass as the electron, and carrying a positive charge of about the same value as the negative charge of the electron. The electron has long been supposed to have the exclusive distinction of being the smallest known unit of matter and the basic natural electrical unit of charge; in fact, the "it" of electricity if not of nature itself. Now it must share its glory with the positron, which even insists that "electron" is too exclusive a word and that "negatron" is more suitable.

But in one respect the negatron has it all over the positron. The former is everywhere in all matter and in countless numbers, whereas the latter seems to have only a rare and fleeting independent existence, only some fifteen of them having as yet been recognized. The positron, like the negatron, moves at high speeds. It can penetrate lead plates and ionizes pretty much everything it approaches. Its path is curved in a magnetic field and the direction of this curvature, as photographed in the Wilson ionization-expansion chamber, opposite to that of the negatron, led to its discovery.

## Substation costs as used

A LARGE substation is designed and built to carry a certain contemplated load. The design engineers quote the design cost and then forget the job. As pointed out by D. K. Blake in this issue, the chances are that the substation never carries the load for which it is designed and consequently there is an excess investment of 20 to 30 per cent if figured on actual loading. The same conditions apply to feeders. As a result, over a period many properties will find that substations and feeders never carry more than 75 per cent of the loads for which they were installed. This is bad engineering and poor economics.

The solution is the use of a more flexible system of distribution and of less permanent or semi-portable substations. There is little reason for the building of large, locally designed substations when factory-built substation units can be purchased that can be changed as loads change. Why spend from $20 to $35 per kilowatt of substation installed capacity, a goodly proportion of which will never be used, when factory-built designs can be purchased for less money and can be moved from one location to another with little expense?

An answer to the flexible distribution system and the full use of the substation capacity is to apply the principle of network distribution wherein feeders are used at all times and wherein a large number of semi-portable substation units replace the few large, permanently located substations so commonly used in the past. We commend the article by Mr. Blake for it points to major dollar savings and gives sound engineering ideas for distribution system design.

# Pertinent Facts in Primary Distribution Economics

By D. K. BLAKE
*Engineer Distribution Systems General Electric Company*

NOW is the opportune time to take advantage of the lack of major system expansion problems and direct the available engineering talent into the field of distribution system economics. It is not the intent of this discussion to prove any particular point, but to present some actual system data for the purpose of:

(a) Stimulating an inquiry into facts as they exist.
(b) Illustrating possible sources of savings.
(c) Emphasizing factors commonly overlooked when comparing systems.
(d) Promoting a better appreciation of the magnitude and variation of distribution system costs.
(e) Showing the complexity of distribution problems.

This particular discussion will be confined to the primary system consisting only of the distribution substation and the 4,000- or 4,600-volt feeders from these substations to the feeding points in the load area. This type of system is general throughout the industry, but is now faced with competition from:

(a) Primary network systems.
(b) 8-kv. to 22-kv. radial distribution systems.
(c) Overhead secondary network systems supplied from 11-kv. to 22-kv. feeders, thereby omitting the intermediate primary system altogether.
(d) A simplified 4-kv. radial system patterned after 120/208-volt secondary network installation now common in large buildings.

The practical limitations placed on distribution systems by the many variable local conditions makes it almost impossible to use theoretical comparisons that assume uniform conditions as a basis for a safe conclusion as to the type of system to be used. Such comparisons are valuable and should be made, but in addition similar studies must be made:

(a) On actual field conditions.
(b) In several different types of localities.
(c) In the light of past experience.
(d) By those or with the assistance of those most familiar with the territory.

Furthermore, systems are so large that today any new competitive system must permit an easy transition from the old to the new and at the same time make the maximum economic use of the older existing system. It has been possible to show in several comparisons that a proposed system could not be justified on a brand new basis, but could be when used in combination with existing facilities, particularly when they have some unused margins of load-carrying capacity.

Therefore, extensive and thorough surveys of the present system are necessary in an economic comparison with a new competitive system, otherwise, certain weaknesses and wastes inherent in the existing system may not be given due consideration. Such surveys must not only take into account system loads and costs as they are but also as they have been over a period of years.

Take, for example, the loading of substations. It is very common practice to consider these as ultimately carrying a load equal to the firm or usable capacity, whereas they hardly ever do. This is particularly true with large substations. Among the reasons for this underloading may be mentioned:

(a) Time required to plan and install a large station with its outgoing feeders and the desire to play safe under conditions of rapid load growth.
(b) Large new facilities must necessarily take load from existing facilities, thereby underloading them substantially.
(c) Failure of the load to develop in the substation territory as fast as expected or else not at all.
(d) Development of the load at a greater distance from the substation, causing poor voltage regulation.

Now, when these existing systems are compared with any of the competitive systems, it is almost always assumed that all the systems will actually carry the same load, when, as a matter of fact, they will not. It is true, of course, that the competitive systems will not necessarily be without a margin of underloading, but their growth in small increments assures a smaller margin of underloading, particularly when fully developed. Therefore, if the competitive system is much lower in cost for the initial stages than a new large radial substation with its outgoing feeders, there are good grounds for questioning the estimate for ultimate costs that might show a slight economy for the latter when it is fully developed.

### Cost per unit of loading counts

The substation investment is very often referred to as costing so much per kva. and sometimes very low values are given, such as $10 or $15 per kva. Very often they refer to the installed transformer rating, but this has very little meaning. The firm or usable capacity is more reasonable, but even this may be misleading. The figure of real significance is the cost per kva. of actual load carried. A substation costing $20 per kva. of installed capacity will cost $24 per kva. of firm or usable rating and $30 per kva. of load carried if it is 80 per cent loaded and $40 if 60 per cent loaded. The larger the substation the more chance there is of being misled regarding actual economies, for it is quite possible that a small substation having a higher cost per kw. of firm capacity will be much easier to maintain fully loaded and will in reality have a lower cost per kva. for the load actually carried.

It is unfortunate that company records generally are such that the history of substations and feeders giving actual initial and subsequent expenditures cannot be traced back to the beginning so that this could be compared to the load carried from year to year. Distribution systems are never completed structures, but are

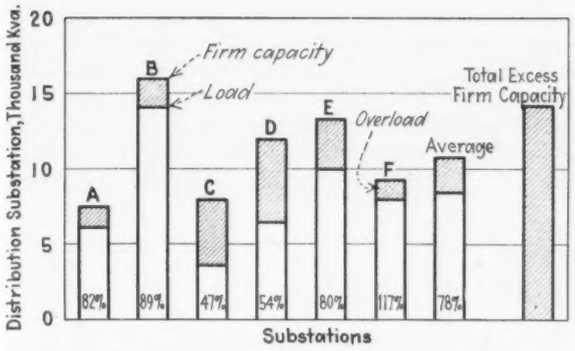



**Fig. 1—Total excess firm capacity in these substations exceeds load of largest**

The firm or usable capacity rating is the load the substation will safely carry under emergency conditions and usually is substantially lower than the installed transformer and transmission supply circuit capacity. Money was spent for features and facilities to carry a load equal to the firm capacity. All six substations are taken from one system. One is overloaded and five are underloaded. One involves some risk and five involve some waste.

continually being changed or added to. Past experience regarding expenditures would be quite valuable in weighing the advantages of different schemes.

High-grade engineering talent and elaborate expensive measuring facilities are employed and heavy capital expenditures are made to reduce generating station production costs one or a fraction of a mill per kilowatt-hour. Production costs long ago reached a value where it is easy for the money saved in generating stations to be more than offset by corresponding wastes in the distribution systems. This can be easily shown in some cases by the substation costs alone where the capital charges for interest, taxes and depreciation may equal production costs. These costs in the aggregate are more pertinent than production costs, for they go on just the same during periods of depression. Therefore, if some practical distribution plan can be developed to make use

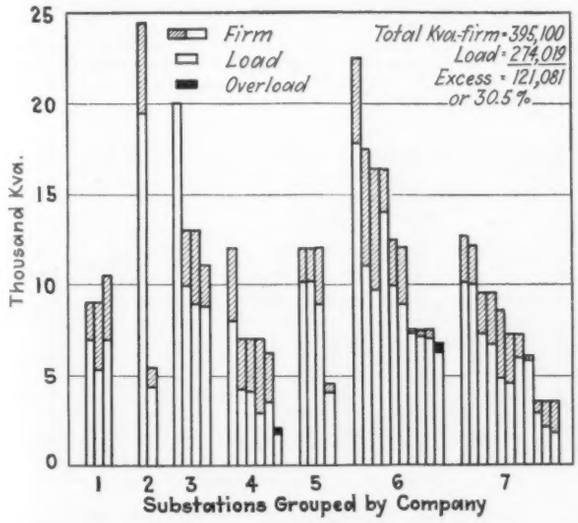



**Fig. 2—Underloading of substations is common to most companies**

Forty substations in seven different cities have an average loading, for the whole group, of about 70 per cent. It might very well be that a system could be underloaded and at the same time be the best economic solution to that particular problem. However, underloading of facilities is a factor that needs to be taken carefully into account when comparing system costs.

of the substation capacity which is already available, the mills per kilowatt-hour on substation charges can be reduced an amount corresponding to reductions now being made in production costs.

Substations are too often considered as being separate and distinct from the distribution system. When it comes to making actual expenditures it is altogether necessary that they be considered as a part of the distribution system. They cannot properly be located and loaded without careful co-ordination with the distribution feeders which they are to supply. Failure to do this accounts for considerable overbuilding of substations and high expenditures for some distribution feeders. The importance of the distribution feeders from the pothead at the substation to the feeding point in the feeder load area has not been fully appreciated in their bearing on:

(a) The size of substations.
(b) Location of substations for best over-all economic results.
(c) Relative over-all costs when compared with competitive schemes.

The feeders may cost as much as the substation itself, particularly when low-cost substations are involved and

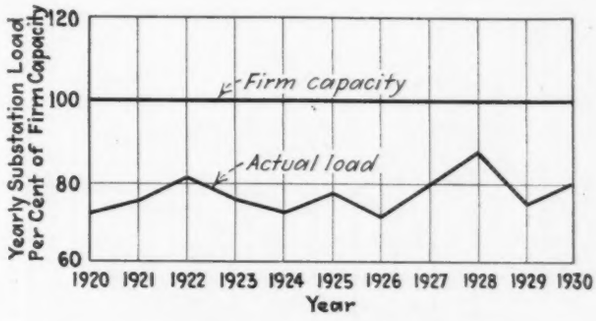



**Fig. 3—History reveals that excess substation capacity hovers between 10 and 30 per cent**

This record of a typical substation shows it never carried the safe load it could carry and for which money was spent. The depression is not the cause of this underloading. Practical difficulties such as feeder voltage regulation or the necessity of providing new facilities substantially in advance of the load inherently cause an appreciable margin of underloading.

the feeders are underground. Furthermore, they do not necessarily follow the theory that they decrease in cost (because of shorter length) as the load density increases. This would undoubtedly be true if all factors remained constant, but they seldom do in actual practice. For instance, increasing densities usually involve more costs for underground construction that offsets the shorter length of feeder.

### Feeders frequently underloaded

Underloading of feeders seems to be more common than underloading of substations. Feeders often cover a territory where loads develop slowly, if at all. It occasionally happens that large power users increase their requirements to a value that necessitates 11,000 or 13,000-volt feeders. These cases also involve some customers whose load increase is just sufficient to justify the 13,000-volt supply at a lower rate. Consequently additional money must be spent for 13,000-volt lines and equipment and at the same time load must be removed from a perfectly good circuit already represent-

ing a substantial investment. Again, the industrials of such size that have been supplied from 4,000-volt circuits are not always so stable and are very likely to go out of business or remove to another locality. Individual feeder circuits may frequently cost as much as $25,000 to $35,000 and a few may go as high as $50,000 to $60,000, depending, of course, upon the amount of underground construction and the total length of the circuit. Expressed another way, a number of feeders are on record that cost as much as $30 to $60 per kva. of actual load carried. A few may go as high as $100 to $138 per kva. of actual load carried. These figures are for the circuit from the substation to the feeding point. Such high costs are almost invariably associated

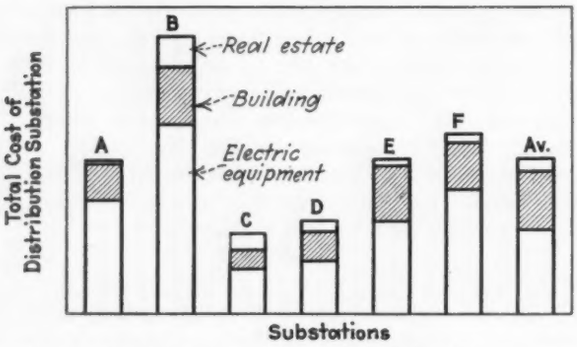



**Fig. 4—Substation real estate and buildings constitute almost half of average substation investment**

The investment in substations varies widely. It commonly ranges between $250,000 and $750,000 in value. A very substantial portion of the total cost must be spent for the initial load.

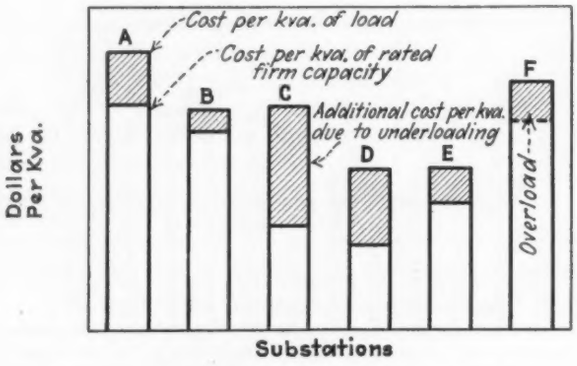



**Fig. 5—Substation cost per kva. of load is important factor**

Substation costs per kva. of firm capacity (a higher value than the installed capacity cost per kva.) vary about the same as investment. However, the cost per kva. of load actually carried may be considerably higher than the cost per kva. of rated firm capacity. Hence, for the system as a whole, substation costs per kva. based on rated installed capacity or rated usable capacity are almost meaningless. It will be observed that in this particular case the cost per kva. of actual load carried on all substations is at least double that of the substation having the lowest cost per kva. of rated usable capacity.

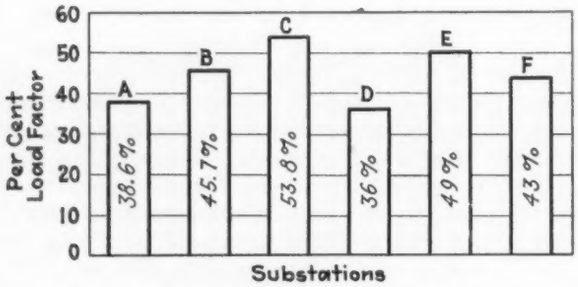
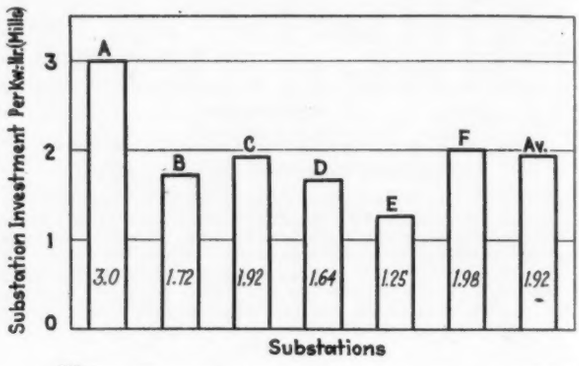
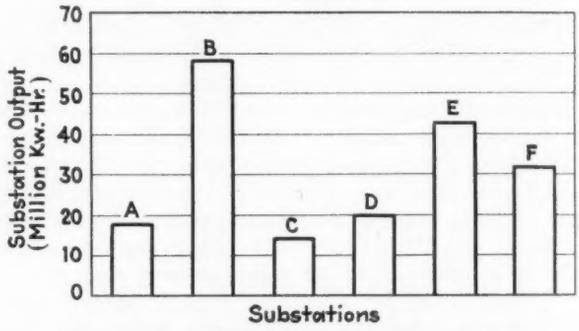



**Fig. 6—Substation load factors are seldom as good as these**

Such load factors are nearly representative of generating stations.




**Figs. 7 and 8—Investment charges per kw.-hr. for six substations and corresponding outputs**

The investment (Fig. 4) in each substation multiplied by the usual percentage gives the annual charges for interest, taxes and depreciation. Dividing this by the kilowatt-hour output gives the substation investment cost in mills for each kilowatt-hour. Such costs approximate production costs of modern generating stations. Operation and maintenance are yet to be added for the complete substation cost per kilowatt-hour.

Because of the high load factors the kilowatt-hour output of these substations is higher for the corresponding peak loads than that usually found. Compare these with the investments of E vs. F and A vs. D in Fig. 4.

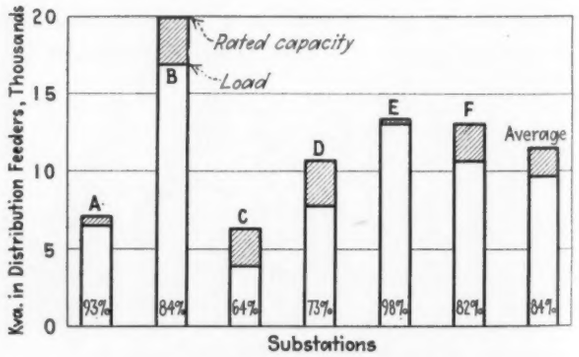



**Fig. 9—Distribution feeders also are usually underloaded**

Distribution feeders running from the substation to the feeding point in the load area to be supplied are generally underloaded similar to the substations. The feeders out of these particular substations are better loaded than is generally found in the industry. Comparing with Fig. 1, it will be seen that on the average total rating of the feeders out of the substations is in excess of the substation rated firm or usable capacity. Individual cases where this is not so means that the substation is not yet fully developed.

with power loads that for some reason or another are not up to expected size.

Now it is contended that any of the competitive schemes are better suited to meet with such adverse conditions because they make a greater use of higher voltage and less use of 4,000-volt feeders or else eliminate the intermediate voltage altogether. However that may be, it is certainly unwise to reject them when they

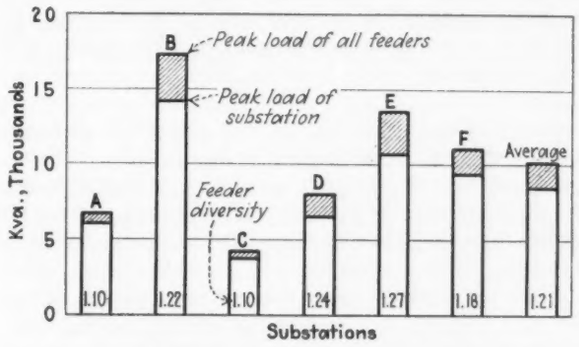



**Fig. 10—Feeder capacity exceeds substation firm capacity 21 per cent**

The top of each column represents the sum of the peak loads of all feeders out of each particular substation. The lower portion of each column shows the peak load for each substation. The figures in each column represent the diversity factor or the total column divided by the lower portion. Diversity factor shows how much the feeder capacity must exceed the firm or usable capacity of the substation even when each feeder is fully loaded. The average for the six substations is 21 per cent—a substantial amount.

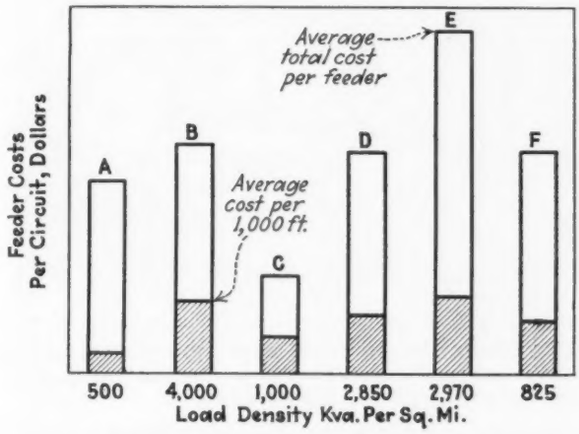



**Fig. 11—Feeder costs apparently do not decrease with higher load densities**

Each column represents the average cost of the feeders for each substation. The shaded portion represents the cost per 1,000 ft. The figures under each column give the average load density in kva. per square mile for each substation. Feeder costs may range anywhere from $5,000 to $20,000 as an average for each substation, with some individual feeders going as high as $50,000, depending principally on the length of underground construction required.

**Fig. 14 (Right)—Feeder losses alone reduce revenue capacity of substations appreciably**

The lower portion of each column gives the peak loss for the loads now being carried. They range from 50 kw. to 200 kw. approximately. At full 300 amp. the minimum loss would be 100 kw. and the maximum almost 300 kw. The feeder losses alone are a substantial amount for a large substation such as 15,000 kva., corresponding to an average feeder load. Thus, the substation is virtually reduced in carrying capacity that is revenue producing.

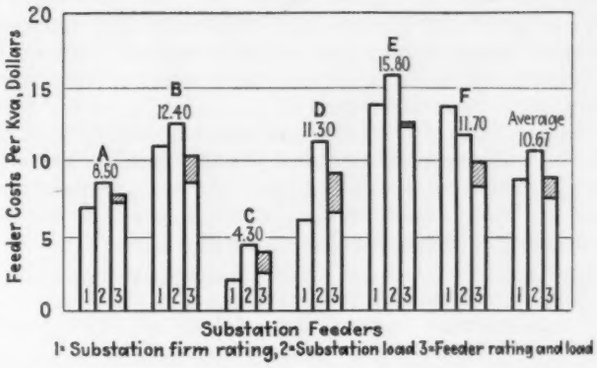



**Fig. 12—Feeder costs per kva. of substation load important in comparing systems**

Feeder costs per kva. based on the substation load actually carried are of sufficient magnitude to make it imperative that they be given full consideration when comparing systems and when alternative substation locations are being considered from the viewpoint of real estate costs. The center column gives this cost per kva. of substation load actually carried. The other columns show how these costs vary when referred to the firm rating of the substation and the feeder ratings and loads.

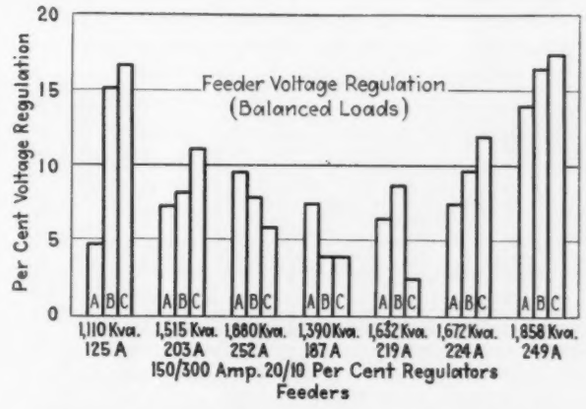
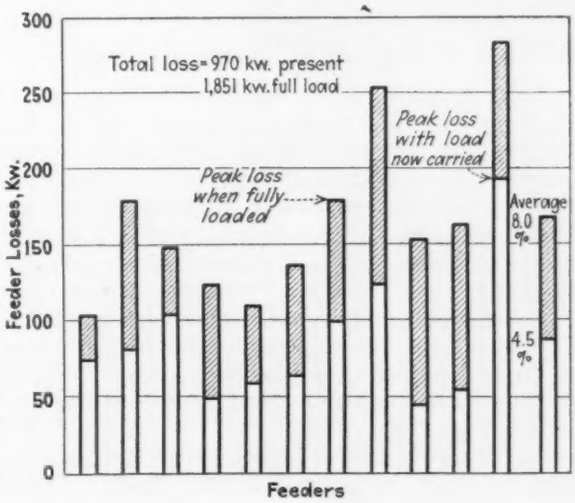



**Fig. 13—Loads on these circuits cannot be increased to 300 amp. without poor regulation**

Voltage regulation is often the occasion of building new substations and adding new circuits before existing facilities are fully loaded. This very often happens where supposed economy was obtained by using 300-amp. circuits instead of 200-amp. circuits in overhead areas of moderate load density. Some of the above circuits are already beyond the 10 per cent boost of the regulator. Even with a high bus voltage to utilize the buck side of the regulator there is very little room left for compensation to provide for distribution transformer and secondary drop. A, B and C represent individual phases.



prove to have a slightly higher cost, say less than 10 per cent, without giving due consideration to the possibility of their fitting into actual conditions better and requiring less reliance on estimated load growths, especially as to time and place.

As a matter of fact, it is not at all necessary to speak of "competitive systems," but "supplementary systems" instead, for it simply is not true that one particular system excludes all the rest. It is conceivable that the best solution to the distribution problem may be:

(a) Maintain the present radial substations and feeders and keep them loaded to their full firm capacity.

(b) Superimpose a high-voltage (13-kv. or 22-kv.) radial system over the territory.

(c) Supply industrial loads and other territories by radial laterals from these circuits where clearances will permit and interruption due to the greater exposure is unobjectionable.

(d) Supply primary network systems, small simplified radial substations and overhead secondary network from these same high-voltage circuits according to the economics of each particular locality.

Thus, it will be possible to supply at least four distinct areas of different circumstances and conditions from one set of high-voltage distribution feeders. Where conditions are right advantage could be taken of the economy of one transformation by simple high-voltage, radial distribution. When this cannot be done the intermediate voltage can be used, employing either small radial substations or a primary network system. It will always be possible to have overhead secondary networks where maximum continuity is desirable or where high load densities occur in limited areas.

Very substantial economies can sometimes be made by combining radial substations with primary networks and thus permit complete utilization of existing substations and feeders, particularly where the load develops too far away from the substation to give good voltage regulation. This can be easily accomplished by locating a network unit in the area where the load is developing and tying it in with the feeder from the substation supplying that territory. Thus, the reserve capacity of the substation is also available for the primary network as well. Some of the other competitive schemes will also permit the introduction of new capacity at centers of new load development too far away from existing substations and make it possible for the present substations and feeders to be loaded up to the full rating with whatever load develops within their reach. On the other hand, some of these new systems present their problems when trying to introduce them without involving extensive line rebuilding and retiring some equipment.

### Increased circuit rating not always economical

One of the methods used to reduce distribution costs has been to increase the circuit rating from 150 to 200 amp. to 300 amp. That economy will result seems almost obvious when it is considered that a 15,000-kva. substation would have, say, fifteen 200-amp. circuits or ten 300-amp. circuits. The number of circuit positions in a substation has a very pronounced effect upon the substation cost. Therefore, the substation would have a much lower cost per kva. with ten circuit positions instead of fifteen. Likewise, ten circuits would require less duct space or cause less pole congestion, either of which results in substantial savings in the distribution circuits themselves.

However, the economies of higher circuit ratings have been taken too much for granted in many cases. There are numerous cases where it can be shown that the 300-amp. circuit does result in very substantial economies. Sometimes new substations are added because of fear of overloading existing substation transformers, but in many cases they are added because the voltage drops on the distribution feeders become too great to be handled by the feeder regulators. This simply means that, for the rating of the feeders, the load density is too light and so the feeders are too long. The practical result of this situation is that a new station will have to be added, not because present circuits and substations do not have enough carrying capacity from the heating point of view, but because the voltage drop in the feeders is too high. The introduction of this new substation at such a time has the effect of wiping out whatever savings were thought to be made by the use of a fewer number of 300-amp. circuits. Of course, eventually, the circuits might be fully loaded after their distances have been cut back to a point to operate within the range of the regulator. It simply means that the use of larger feeders under these circumstances requires many years before they can be loaded to their full rating, whereas smaller circuits of two-thirds rating, namely, 200 amp., can be loaded more easily and efficiently.

As a general statement, it may be said that the use of 300-amp. circuits are safe when most of the circuit is underground cable, for then the voltage drop would be quite small, but where practically the whole circuit is overhead construction the use of 300-amp. circuits should be first mentioned and then very carefully analyzed to see that it is the best economic solution.

The development of a system under conditions of load growth so rapid that it is barely possible to keep up with it may not require very much concern over the factors affecting underloading that have been discussed. However true this may be for the system in general, experience has shown that it is not true for many particular territories. Furthermore, added to this is the experience in recent years of delayed load development and of actual decrease in many instances. Therefore, any system that will supplement the present system with facilities and expenditures in small increments at the time and place the load occurs is much to be preferred because it does not commit one too much to the future. In addition to this, too much speculation is involved in systems having larger initial expenditures, even though the estimated saving is 10 or 30 per cent when ultimately developed and fully loaded.

A little consideration of distribution system facts will show that the economic aspects are quite complex and certainly justify:

(a) The best engineering talent available, with most emphasis on the faculty of good judgment.

(b) Extensive surveys with adequate measuring facilities to obtain more accurate and reliable data.

(c) Thorough analysis during this period of so-called depression.

The accompanying illustrations are not intended to prove a general condition in the industry. They represent actual conditions on a few systems. They do show the facts for these cases and also show how variable distribution data and costs might be even on a particular system. Any one can prepare similar information from his own system data and will undoubtedly find it a successful method for interpreting the facts.

# Industry Sag Shows Moratorium Effect

Interpretation of statistics of industrial activity for March is made difficult this year by several factors. Based on reports of electrical energy consumption by various groups of manufacturing plants, with allowance for differences in the length of the working month, a general decline is indicated compared with February. But, as has previously been pointed out, the reading of meters at the end of the short month seems in many cases to be delayed a day or two. This practice favors February at the expense of March. It results in an annual rise of the index for the former month, followed by a fall, but there seems to be no way of ascertaining the magnitude of the error thus introduced.

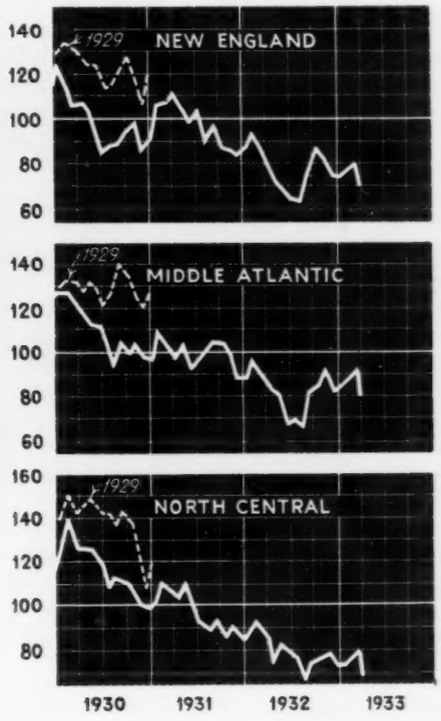
A further complication arose this year because of the "bank holiday" which, according to news reports, led to curtailment of factory operations during the first half of the month. The effect was promptly evident in the sharply decreased weekly energy consumption as announced at the time.

The combined effect of these various influences was not only to lower the March index but to widen the gap between 1932 and 1933 by 2 per cent compared with the preceding month.

Whatever improvement may have occurred during the latter part of the month is thus obscured by the disturbances during the first part. The automobile industry was particularly responsive to unsettled conditions. The index fell 28 per cent from February. This helped to carry down the general average of activity not only for the United States as a whole but especially for the North Central area. Rubber moved similarly.

The stone, clay and glass group resisted the decline, despite the upward revision of the February index to incorporate improvements revealed by late returns. Other revisions made necessary by delayed reports were generally small. Iron and steel in the Middle Atlantic region was one of the few industries to report an increase over February. In the figure for the country as a whole this is overbalanced by losses elsewhere.

Previous year
Average Monthly Manufacturing Activity 1923-1925=100
Index of manufacturing activity
Jan. Mar May July Sept. Nov. Jan. Mar May July Sept Nov Jan. Mar May July Sept Nov. Jan Mar May July Sept Nov
1930
1931
1932
1933




**Index of monthly manufacturing activity**

**Base: Average month 1923-1925 = 100**

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

| | United States | | | | New England | | | | Middle Atlantic | | | | North Central | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Industrial Groups | Mar., 1933 | Feb., 1933 | Jan., 1933 | Mar., 1932 | Mar., 1933 | Feb., 1933 | Jan., 1933 | Mar., 1932 | Mar., 1933 | Feb., 1933 | Jan., 1933 | Mar., 1932 | Mar., 1933 | Feb., 1933 | Jan., 1933 | Mar., 1932 |
| *All Industry* | *74.5* | *85.8** | *81.9* | *88.0* | *70.5* | *79.8* | *75.5* | *83.9* | *79.3* | *91.8** | *85.7* | *84.2* | *67.8* | *80.5* | *76.3* | *88.4* |
| Automobiles (including parts and accessories) | 44.0 | 61.2 | 59.2 | 72.8 | ..... | ..... | ..... | ..... | 43.3 | 63.7* | 65.5 | 68.1 | 44.2 | 60.2 | 58.7 | 73.6 |
| Chemical products (including oil refining) | 114.2 | 130.0* | 126.0 | 125.1 | 141.5 | 138.8 | 147.0 | 134.4 | 120.3 | 138.0* | 133.6 | 142.0 | 99.0 | 120.7* | 116.0 | 105.5 |
| Food products | 99.6 | 112.5 | 107.5 | 114.7 | ..... | ..... | ..... | ..... | 93.8 | 111.1* | 106.0 | 86.4 | 97.0 | 108.3 | 104.7 | 100.7 |
| Iron and steel | 50.5 | 64.2 | 58.4 | 66.4 | 82.2 | 83.8 | 68.8 | 99.2 | 51.3 | 47.5* | 47.0 | 61.1 | 56.0 | 73.7 | 65.5 | 69.7 |
| Metal working | 50.5 | 58.4 | 52.8 | 64.8 | 64.2 | 75.7* | 70.0 | 83.0 | 47.2 | 54.1 | 50.3 | 65.0 | 50.1 | 56.5 | 51.2 | 60.9 |
| Metals group | 50.5 | 60.6 | 54.7 | 65.4 | 69.3 | 78.2* | 69.7 | 87.5 | 48.9 | 51.3* | 48.9 | 63.3 | 52.3 | 60.1 | 56.5 | 64.2 |
| Leather products | 84.0 | 95.0* | 83.6 | 86.7 | 74.0 | 88.2* | 76.4 | 70.8 | 117.9 | 107.1* | 95.8 | 104.8 | 66.8 | 88.2 | 77.1 | 75.2 |
| Forest products | 79.0 | 91.0* | 90.4 | 78.2 | 37.4 | 51.8* | 38.9 | 46.3 | 49.0 | 57.5* | 54.2 | 42.6 | 58.4 | 77.1* | 67.7 | 98.4 |
| Paper and pulp | 96.2 | 111.0* | 104.4 | 114.4 | 90.3 | 103.5 | 99.2 | 117.7 | 74.7 | 89.9 | 83.2 | 72.3 | 92.7 | 108.3 | 98.1 | 103.9* |
| Rubber products | 68.0 | 91.0 | 85.2 | 96.8 | 65.2 | 91.7* | 89.7 | 84.0 | ..... | ..... | ..... | ..... | 66.9 | 88.0 | 81.5 | 105.7 |
| Shipbuilding | 70.2 | 89.2 | 83.5 | 84.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Stone, clay and glass | 65.4 | 67.2* | 58.5 | 81.9 | ..... | ..... | ..... | ..... | 49.6 | 48.4* | 43.3 | 63.9 | 65.5 | 82.5* | 73.7 | 88.6 |
| Textiles | 77.4 | 84.1 | 85.0 | 86.0 | 56.5 | 63.7* | 63.7 | 71.3 | 101.1 | 123.0 | 111.8 | 95.5 | 106.6 | 120.9* | 109.2 | 110.9 |

*Revision.

# Light for Merchandising

By F. H. PEARSON*
*Consulting Engineer Merchandise Mart, Chicago.*

**Lighting cost a small part of sales cost.**
**Values from light are tangible.**
**Intangible assets equal the tangible.**

RETAIL merchandising of today is conducted upon a very close marginal basis, considerably more so than at any time during the past decade, during which period the question of operative costs did not have the significance that they have under present retailing conditions.

While the item of purchased service, or electric energy for light and power purposes, is a relatively minor item in the total of operative expense, yet each item making up the total cost of doing business bears a certain percentage relation to the cost of sales, and it, therefore, becomes necessary to confine each of these items within very narrow limits.

It is customary to set up certain budget figures under this control for each item of expense, including an arbitrary figure covering the cost of lighting, based upon the generally accepted standards of illumination. From this is established a common figure representing a so-called permissible cost of lighting to sales, expressed as a percentage. This common cost figure under normal conditions will vary from 0.25 to 1.50 per cent of sales, dependent upon the size of the store, volume of the sales and character of the business. However, under present conditions, these figures exhibit an increase of from 20 to 35 per cent, due to the fact that while volume and prices have undergone a very decided reduction, the cost of illumination has remained at approximately the same as under normal conditions of trade. This is a practical illustration of what has taken place in the merchandising field in the past two years, and while the percentage figures are purely arbitrary, they represent a fair average of actual conditions.

In substantiation of the above statement it will be interesting to consider the relative difference in the cost of energy for lighting purposes in percentage of sales under normal conditions and the present, using for that purpose average common figures set up for this item:

| | (Per Cent of Sales) Normal | Present | Actual Per Cent Increase |
|---|---|---|---|
| Large department stores | 0.27 | 0.36 | 33⅓ |
| Medium department stores | 0.60 | 0.80 | 33⅓ |
| Small department and dry goods stores | 0.56 | 0.70 | 25 |
| Drug stores | 0.80 | 1.10 | 37½ |
| Grocery stores | 0.50 | 0.60 | 20 |
| Specialty shops | 1.20 | 1.50 | 25 |

It will be noted that there is a substantial difference between the cost of lighting for the three classes of department stores. There are two reasons for this, viz.: (1) Greater sales volume and spread of fixed and operative expenses in the case of the large stores; (2) the greater energy consumption of the larger stores, thus obtaining the advantages of the lower bracketed rates charged for energy.

Specialty shops show a relatively high cost, due to the use of show windows for a greater number of hours and also more extended employment of decorative lighting. Drug stores exhibit a somewhat higher rate, due to longer operating hours. Grocery stores show approximately the same lighting charges as the small dry goods store, both operating upon about the same hourly basis.

This brings into consideration the question as to what determines the normal permissible cost of lighting to sales and what may be properly assumed as the threshold intensity of illumination, or, in other words, what foot-candle intensity will produce maximum sales at a minimum cost? Or, at what intensity does any increase cease to produce increased sales, proportionate to the increased cost of the higher level of intensity?

Numerous attempts have been made and a great many surveys conducted for the purpose of developing certain data indicating the relation between foot-candle intensity and sales velocity. Many of these surveys were made by eminent engineers and students of economics in the lighting field.

The usual manner of conducting these tests consists in selecting a certain department in the store, covering the area with a system of illumination, arranged for progressively increasing the intensity from day to day, and tabulating sales against intensities each day for periods of 30 days or more and, from the data secured, plotting a characteristic curve, presumably showing some relation between intensity and sales velocity.

The results of these tests have been disappointing, due to the presence of many variable factors, such as the day of the week, weather conditions, reaction of salespersons, seasonal merchandise, style and other considerations. In fact, it is almost impossible to repeat performance curve characteristics from day to day or week to week.

It is therefore obvious, and a lamentable fact, that it is quite impossible at present to establish by test any definite, economical, optimum level of illumination for merchandising which can be capably supported.

It would seem, therefore, that the rational method of determining correct intensities of illumination for various departments and lines of merchandise should be based upon conclusions reached as a result of experience, observation and measurement, taking into consideration the reaction of customers, salespersons and management, together with display, ease of examination and selection of merchandise, as well as returns due to dissatisfied purchases.

Several lighting codes have been published, recommending certain foot-candle intensities for various departments and lines of merchandise and are practically the only source of information available today. They

**Abstract of paper presented at the Lighting Conference, Case School of Applied Science.*

probably offer the safest guide for the design of lighting systems for department and other stores. However, experience in the use of some of these tables has proved somewhat unsatisfactory and open to some criticism from the standpoint of correct values of illumination for various lines of merchandise, due to the fact that consideration has not been given to some of the factors entering into the problem concerned, from a sales standpoint.

Another angle of this question is closely related to the subject of permissible costs of illumination under prevailing merchandise conditions, previously referred to. Under the stress of diminishing volume and retail prices, existing in the retail trade, with the consequent increased ratio of expense, it is of paramount importance that the cost of doing business be reduced to a minimum. This, of course, calls for a reduction of every item of expense possible and the natural tendency is to reduce the item of lighting expense proportionately with other items.

The question as to the wisdom of extending these reductions to include lighting costs calls for a very fine discrimination on the part of merchants and executives. Generally speaking, it would seem unwise to attempt any reduction of lighting expense by curtailing the amount of illumination in active departments; whatever economies are effected should preferably be secured by adjusting the hours of burning and the number of units in the less active departments and sections of the establishment.

Any let-down in the degree of illumination of the store, significant as to cost, is quickly apparent to the customer and has an unfavorable reaction. On the contrary, the present difficult conditions of merchandising might easily justify an increased intensity of illumination in many active departments, rather than a reduction.

In this connection a fact often lost sight of is that the maximum demand and total energy consumption generally exceeds the kilowatt-hours included within the bracketed rates by a considerable margin.

Any moderate decrease or increase in demand or consumption will take the rates established in the lower brackets. The point to be made here is that the amount of saving or increase in the cost of lighting, under these conditions either below or above normal load, will not be based upon the average rate.

▼

## Electric-Steam Generator Saves Standby Costs

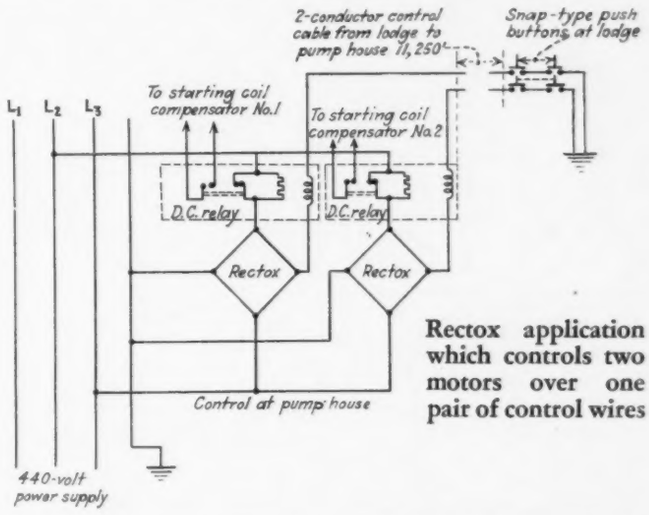
At its Kamloops auxiliary steam-electric generating plant the British Columbia Electric Railway Company, Ltd., Vancouver, B. C., has made an interesting application of electric heat by using excess hydro power to save standby charges. At this station a 1,500-kva. steam-generating unit is held in reserve as an emergency source of power.

To save time in getting the unit on the line the boilers and turbines are kept hot. As surplus power was available from the hydro-electric system of the company, engineers of the company designed and constructed an electric-steam generator made entirely out of pipe and pipe fittings. The generator consists of two three-phase, 75-kw., 220-volt units connected to run singly or in parallel. The installation has proved entirely satisfactory and the savings in expenditure on fuel oil, which was formerly necessary to maintain heat, have more than offset the interest charges on the cost of the generator.

▼

## Rectox Unit Saves Extra Control Circuit

Addition of a remote motor-driven pumping unit to supply Sunrise Lodge and the public camp grounds at Rainier National Park presented a control problem that may have its counterpart elsewhere. This pump had to be installed in an unattended pump house, 2 miles distant, where there was already a pump served from the lodge by a three-conductor parkway cable supplemented by a bare neutral and controlled through an automatic compensator over a two-conductor trenchlay cable. Park regulations prohibited installation of an overhead circuit for controlling the new unit and money was not available for a second underground control circuit.




**Rectox application which controls two motors over one pair of control wires**

The accompanying diagram shows how the existing circuits were utilized so as to give push-button remote control of both units.

By using the neutral and each control wire two two-wire circuits were available. Two rectox units were connected across one phase of the 440-volt power supply at the pump house. One of the direct-current output terminals on each unit was connected to ground and the other to one of the control wires, each circuit being modified to include a small d.c. relay having a "normally open" and a "normally closed" set of contacts. The former energize the starting coils of the automatic compensators whose relays complete the sequence necessary to put the units on the line. The "normally closed" contacts which shunt out a resistance are in series with the a.c. supply to the rectox unit. When a pumping unit is in operation these contacts open and insert the resistance in the line, thereby limiting the output of the rectifier to a current value just sufficient to keep the d.c. relay energized. As it is necessary to keep the control circuits energized as long as the units are running, snap-switch type push-buttons had to be substituted for the usual momentary contact type.

# Motor and Control Applications in New Anthracite Breaker

By RAYMOND A. HOPKINS *
*Consulting Electrical Engineer*

**Methods of handling some of the major electrical problems encountered in providing reliable economical operation of an anthracite coal breaker were discussed by the author in the April 15 issue of "Electrical World," his remarks being tied up with a specific installation, the Philadelphia & Reading Coal & Iron Company's plant at St. Nicholas, Pa. Special attention was given to protection of the equipment and wiring against water and dirt, economical distribution of the power required and interlocking related operations. In the current issue he deals with the factors affecting the selection of motors and controls for a variety of purposes, giving data on the principal drives and including interesting indicating and sequence control schemes.**

THE most important requirements governing the selection of motor and control characteristics for any coal breaker are: Running horsepower, starting torque, speed control, accelerating torque and reversing requirements. For simplicity and interchangeability, machine drive motors are often 900 r.p.m. and pump and fan motors 1,200 r.p.m. Running horsepower is calculated from the work done by the machine and the efficiency of the machine with its mechanical drive. The calculation must always include friction coefficients and safety factors derived from experience with this type of drives.

Starting torque cannot be calculated readily, but may be determined by turning the machine a few degrees from rest or through the region of greatest torque by means of a spring balance on a lever arm attached to the drive pulley. A large factor influencing the starting torque in some cases is static friction. Another is the condition of loading.

Reciprocating machines, such as screens and feeders, develop pulsating torques whose peaks must be encountered in starting. The double squirrel-cage induction motor with starting torque of about 250 per cent approaches the requirements for this class of drives, but even with this motor a size must usually be selected larger than needed for running horsepower, merely to obtain sufficient starting torque.

On the other hand, a centrifugal water pump or a fan develops a torque very low at start but increasing rapidly as the machine comes up to running speed. The double squirrel-cage induction motor with a starting torque of about 80 per cent is suitable and the motor size may be selected to suit the running horsepower.

Cone agitators develop very heavy starting torque and the applied torque must be under the direct control of the operator. Slip-ring motors and three steps of torque control are provided.

The general range of starting torques of the more important drives in the Philadelphia & Reading Coal & Iron Company breaker at St. Nicholas, Pa., in per cent of running torque, are as follows:

| | |
|---|---|
| Water pumps and fans | 10– 50 |
| Belt conveyors | 100–300 |
| Roll crushers | 200–400 |
| Reciprocating screens and feeders | 200–900 |
| Cone agitators | 300–900 |

Speed control is required in a few cases to regulate the flow of materials through the process. Slip-ring motors, secondary resistors and three to eleven steps of control are used for this purpose.

The accelerating torque of the squirrel-cage motor is likely to develop unsafe stresses in such drives as long, high-speed conveyors when starting loaded. For such cases slip-ring motors are provided. The controllers are designed to limit automatically the starting torque and the time intervals between steps to predetermined values.

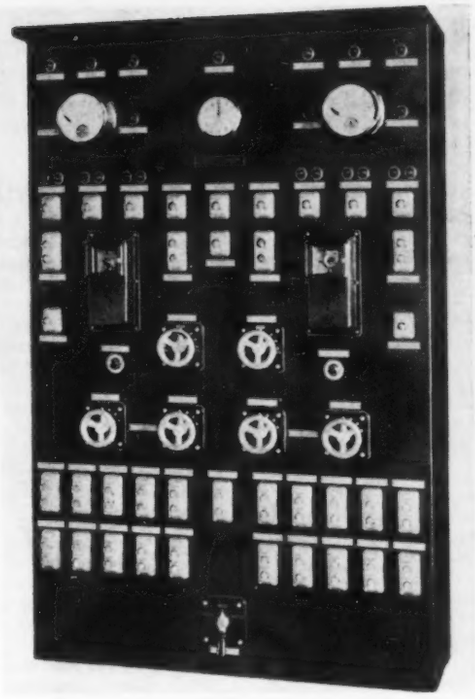
Reversing control is required for the loading boom hoists and most of the roll crushers. The loading booms are lowered and raised to keep the delivery ends close to the coal in the car and thus minimize degradation of coal. The rolls are sometimes reversed to free them if they become clogged.

The accompanying table gives approximate data on typical examples of the application of motors and controls as used in the St. Nicholas, Pa., breaker.

*Coal-Level Indicators*—Coal-level indicators are provided in the pea, buck, rice and barley coal-storage bins to give the operator below continuous indication of the amount of coal in each bin so he can advantageously arrange the cars for loading. The device is simple, inexpensive and reliable. It consists of electrodes in the bins connected to lamps near the operator, so arranged that the lamps are lighted when the coal is in contact with the electrodes (Figs. 3 and 4).

*Cone Refuse Timers*—Refuse from the cones (Fig. 5) requires trapping every three to ten minutes, depending on rate of coal flow and amount of refuse extracted. The trapping cycle involves (1) closing the filler valve, (2) opening the upper refuse gate, allowing the refuse accumulated in the classifier column to drop into the refuse chamber, (3) closing the upper refuse gate, (4) opening the lower refuse gate, allowing the refuse to

*Formerly electrical engineer Stone & Webster Engineering Corporation.



**Figs. 1 and 2—Secondary cone and loading control panels**

Two timers for two cones may be seen about midway up on the panel, housed in rectangular cases with glazed doors. The timers were built mostly from standard parts of sign flashers, using heavy-duty mercury switches with a continuous rating of 30 amp. at 220 volts and capable of interrupting 30 amp. at 220 volts, 0.3 power factor. Each timer is driven by a small direct-current motor fed from a rectifier.

A double-throw main switch at the bottom of the panel brings in power from either of two sources for cone control and signals or disconnects the panel if desired. On the primary cone panel only is located a remote indicator of the rate of coal flow on the raw coal conveyor.

**Figs. 3 and 4—Coal-level indicator and electrode used**

Each half of each bin has a set of three electrodes (located to indicate roughly one-quarter, one-half and three-quarter full) and three lamps, since the two loading gates at the bottom of each bin cause unequal coal level at the two sides of the bin. The electrodes are shaped to present large surface to the coal when in contact and to shed the coal readily when it recedes. The electrodes and wiring are highly insulated, since a small amount of leakage would produce false indication. The 2-watt neon glow lamp was selected because the color of the lamp gives good visibility, its life is long and its small current assures successful operation with either wet or dry coal. The exact locations of the electrodes are the result of experimenting, since the surface of the coal assumes radically different profiles during filling and emptying. At a certain distance from the side of the bin, however, the filling and emptying profiles approximately coincide at all capacities.

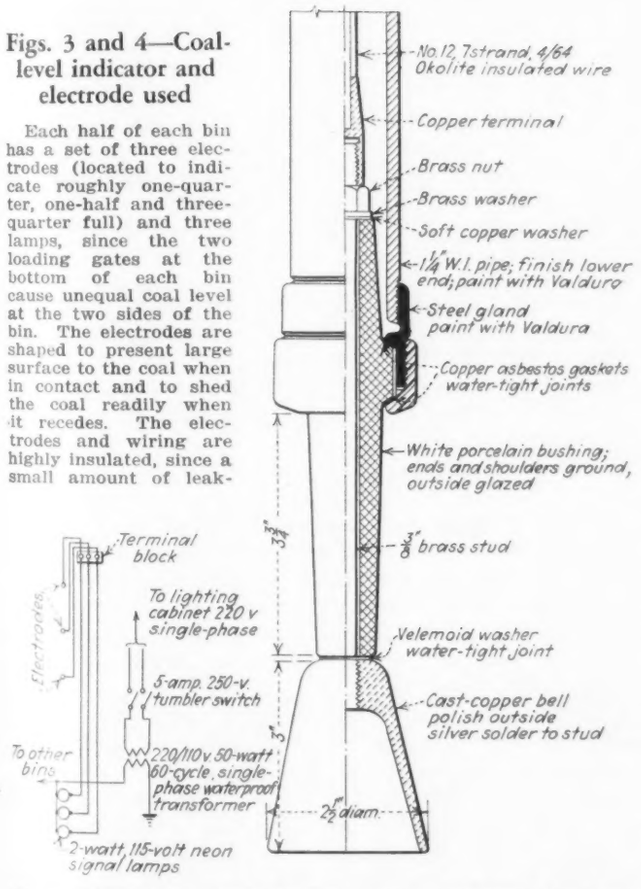
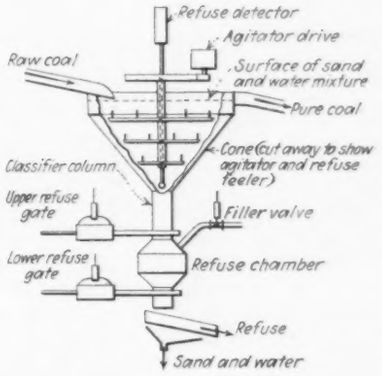

No. 12, 7-strand, 4/64 Okolite insulated wire
Copper terminal
Brass nut
Brass washer
Soft copper washer
1¼" W.I. pipe; finish lower end; paint with Valduro
Steel gland paint with Valdura
Copper asbestos gaskets water-tight joints
White porcelain bushing; ends and shoulders ground, outside glazed
⅜" brass stud
Velemoid washer water-tight joint
Cast-copper bell polish outside silver solder to stud
2½" diam.
3"
3¾"
Terminal block
Electrodes
To lighting cabinet 220 v single-phase
5-amp. 250-v. tumbler switch
To other bins
220/110 v. 50-watt 60-cycle, single-phase waterproof transformer
2-watt, 115-volt neon signal lamps

**Fig. 5—Elements of cone used in flotation process**

The agitator drive, the refuse detector and the timing of the trapping cycle are discussed in the text.




drop onto the refuse screen, (5) closing the lower refuse gate and (6) opening the filler valve. The refuse gates and filler valve are operated by heavy air cylinders which are controlled by air valves of original and clever design. The air valves are actuated by small alternating-current solenoids accurately controlled by automatic timers located on the cone-control panel (Fig. 1). Besides being positively controlled by the timers, the refuse gates and filler valve are all interlocked with each other by means of limit switches to prevent any possibility of more than one being open at one time. Lamps on the panel indicate the position of each gate and valve.

Time for a complete trapping cycle is adjustable from 45 seconds to three minutes by means of a small motor control rheostat on the front of the panel. For best operation the trapping should be done in minimum time. Particularly should the upper refuse gate be opened only long enough to discharge the accumulated refuse. By a novel arrangement, the cam which controls the upper

## *Types of Motors and Control Used to Operate More Than 50 Applications*

Ssc—squirrel cage, 80 per cent starting torque. Sc—squirrel cage, 150 per cent starting torque. Dsc—squirrel cage, 250 per cent starting torque. Sl—slip ring, controllable starting torque. Syn—synchronous, 100 per cent starting torque.

**Centrifugal Pumps**

| Material Pumped | Capacity in G.P.M. | Total Head Including Friction, Feet | Discharge Diameter, Inches | Pump Power, Hp. | Pump Speed, R.P.M. | Motor Hp. | Motor R.P.M. | Motor Type | Control |
|---|---|---|---|---|---|---|---|---|---|
| Water | 11,400/5,700 | 150/179 | 20 | 497/408 | 1,200 | 500 | 1,200 | Syn. | Start-stop |
| Water | 5,900/2,950 | 175/196 | 14 | 301/218 | 1,200 | 350 | 1,200 | Syn. | Start-stop |
| Water | 2,600/1,300 | 175/194 | 10 | 142/ 99 | 1,160 | 150 | 1,160 | Ssc. | Start-stop |
| Water | 1,000/ 500 | 324/358 | 6 | 106/ 76 | 1,760 | 150 | 1,760 | Ssc. | Start-stop |
| Water | 250/ 125 | 250/252 | 4 | 26/ 20 | 1,160 | 40 | 1,160 | Sc. | Start-stop |
| Sump | 2,000/1,000 | 50/ 65 | 8 | 32/ 27 | 1,150 | 50 | 1,150 | Sc. | Start-stop |
| Sump | 1,000/ 500 | 50/ 61 | 6 | 18/ 16 | 1,165 | 25 | 1,165 | Sc. | Start-stop |
| Sludge | 1,500 | 233 | 6 | 250 | 1,160 | 250 | 1,160 | Sl. | 11 step speed |
| Cone sand | 5,200/3,800 | 34/ 26 | 12 | 102/ 58 | 295/253 | 100 | 885 | Sl. | 5 step speed |
| Cone sand | 4,200/3,000 | 29/ 24 | 12 | 69/ 44 | 267/235 | 75 | 880 | Sl. | 5 step speed |
| Cone sand | 2,400/1,500 | 33/ 22 | 8 | 45/ 20 | 414/321 | 50 | 870 | Sl. | 5 step speed |
| Cone sand | 900/ 600 | 23/ 17 | 6 | 12/ 6 | 490/494 | 15 | 496 | Sl. | 5 step speed |
| Refuse sand | 1,000 | 68 | 6 | 38 | 690 | 40 | 690 | Sc. | Start-stop |
| Refuse snad | 1,000 | 58 | 6 | 29 | 690 | 30 | 700 | Sc. | Start-stop |

**Belt Conveyors**

| Width, Inches | Length, Feet | Vertical Distance Load Handled (Ft.) Up | Down | Speed, F.P.M. | Load in Long Tons per Hour | Motor Hp. | Motor R.P.M. | Motor Type | Control |
|---|---|---|---|---|---|---|---|---|---|
| 60 | 840 | 131 | .. | 549 | 1,250 | 300 | 885 | Sl. | Limited acceleration |
| 48 | 837 | 172 | .. | 470 | 450 | 150 | 885 | Sl. | Limited acceleration |
| 42 | 181 | 26 | .. | 334 | 445 | 30 | 865 | Sl. | Limited acceleration |
| 36 | 98 | 16 | .. | 351 | 270 | 15 | 840 | Dsc. | Start-stop |
| 60 | 144 | ... | 12 | 149 | 312 | 7½ | 845 | Dsc. | Start-stop |
| 48 | 113 | ... | 9 | 152 | 222 | 7½ | 845 | Dsc. | Start-stop |
| 48 | 56 | ... | 17 | 152 | 200 | 7½ | 845 | Dsc. | Start-stop |
| 42 | 61 | ... | .. | 231 | 270 | 7½ | 845 | Dsc. | Start-stop |
| **Flight Conveyors** | | | | | | | | | |
| 30 | 146 | 74 | .. | 100 | 98 | 40 | 865 | Sl. | Limited acceleration |
| 24 | 148 | 77 | .. | 101 | 36 | 25 | 865 | Sl. | Limited acceleration |
| 30 | 70 | 7 | .. | 97 | 222 | 20 | 840 | Dsc. | Start-stop |
| 30 | 69 | ... | 5 | 96 | 222 | 15 | 840 | Dsc. | Start-stop |
| 16 | 117 | ... | .. | 100 | 27 | 10 | 835 | Dsc. | Start-stop |
| 15 | 63 | 11 | .. | 99 | 36 | 7½ | 845 | Dsc. | Start-stop |
| **Apron Feeders** | | | | | | | | | |
| 72 | 18 | 2 | .. | 109 | 1,250 | 15 | 865 | Sl. | 5 point speed |
| 60 | 12 | ... | .. | 38 | 625 | 7½ | 875 | Sl. | 5 point speed |
| 30 | 16 | 7 | .. | 21 | 36 | 5 | 865 | Sl. | 5 point speed |
| 30 | 6 | ... | .. | 50 | 135 | 5 | 870 | Sl. | 5 point speed |

**Cone Agitators**

| Cone Diameter, Feet | Raw Coal Long Tons Per Hour | Motor Hp. | Motor R.P.M. | Motor Type | Control |
|---|---|---|---|---|---|
| 18 | 325 | 40 | 865 | Sl. | 3 step starting |
| 16 | 150 | 25 | 865 | Sl. | 3 step starting |
| 10 | 57 | 15 | 865 | Sl. | 3 step starting |

**Reciprocating Feeders**

| Feeder Width, Inches | Feeder Length, Feet | Strokes per Minute | Load in Long Tons per Hour | Motor Hp. | Motor R.P.M. | Motor Type | Control |
|---|---|---|---|---|---|---|---|
| 42 | 8 | 46 | 200 | 7½ | 865 | Sl. | 5 point speed |
| 36 | 7 | 46 | 112 | 5 | 865 | Sl. | 5 point speed |

**Roll Crushers**

| Roll Diam., Inches | Roll Face, Inches | Roll Speed, R.P.M. | Load in Long Tons per Hour | Motor Hp. | Motor R.P.M. | Motor Type | Control |
|---|---|---|---|---|---|---|---|
| 36 | 36 | 50 | 150 | 25 | 850 | Dsc. | Reversing |
| 24 | 36 | 125 | ... | 15 | 865 | Dsc. | Start-stop |

**Shaking Screens**

| Type | Screen Area, Sq.Ft. | Load in Long Tons per Hour | No. of Decks | Motor Hp. | Motor R.P.M. | Motor Type | Control |
|---|---|---|---|---|---|---|---|
| Feed | 112 | 730 | 1 | 20 | 840 | Dsc. | Start-stop |
| Feed | 588 | 275 | 3 | 20 | 840 | Dsc. | Start-stop |
| Scalping | 647 | 470 | 3 | 40 | 670 | Dsc. | Start-stop |
| Scalping | 330 | 275 | 2 | 20 | 840 | Dsc. | Start-stop |
| Scalping | 126 | 275 | 1 | 15 | 865 | Dsc. | Start-stop |
| Desilting | 180 | 90 | 1 | 15 | 1,160 | Sc. | Start-stop |
| Sizing | 813 | 120 | 3 | 30 | 670 | Dsc. | Start-stop |
| Sizing | 545 | 57 | 3 | 20 | 840 | Dsc. | Start-stop |
| Sizing | 371 | 40 | 2 | 20 | 840 | Dsc. | Start-stop |
| Refuse | 336 | 35 | 2 | 20 | 840 | Dsc. | Start-stop |
| Refuse | 108 | 36 | 1 | 15 | 840 | Dsc. | Start-stop |
| Dewatering | 90 | 44 | 1 | 7½ | 870 | Dsc. | Start-stop |

refuse gate is, therefore, made easily adjustable by means of a graduated dial reached through the hinged door on the front of the timer. The operator is thus enabled to adjust readily the timing of the upper gate and of the entire cycle to best suit each grade of coal he is handling.

Initiation of a trapping cycle may be done by a push button on the panel or automatically by a mechanical refuse detector on the cone, or, if desired, the cycle may be set to repeat itself continuously. The refuse detector (Fig. 5) consists of a feeler operated up and down by a small motor. When the refuse has accumulated in the classifier column to such a height as to come in contact with the feeler a switch closes and initiates the trapping cycle.

*Centralized Control*—In keeping with the general objective in the design of the breaker to reduce to a minimum the number of men required to operate it, most of the controls for the process machinery are grouped on a few steel control panels located at advantageous operating positions.

The raw coal operator is stationed at the head of the raw coal conveyor and has at hand the controls for the raw coal conveyor and the main apron feeder which deliver all incoming coal to the primary scalping screens.

The primary cone operator, stationed between the west and east primary cones, controls the primary scalping screens and other screens preceding the cones, the cone

agitators and refuse gates, the screens and roll crushers following the cones and the refuse screen and sand pumps below the cones. He is provided with a panel similar to the one shown in Fig. 1, containing the above controls, also two agitator motor ammeters, a time clock and two-way signals to other operators.

The secondary cone operator, stationed between the west and east secondary cones, has on his board (Fig. 1) a similar complement of controls, instruments and signals for handling the secondary cones and adjacent machines. The pea and buck cone panel and the small cone panel are similar in general to those described.

The loading operator, stationed where he can overlook the loading of the cars, has before him the control board shown in Fig. 2, which controls the feeders, conveyors and diverting gates which deliver the various sizes of coal to the four loading booms, the loading booms themselves with their hoists and the car retarders which permit the cars to feed past by gravity as they are loaded.

In addition to the centralized controls, certain machines such as sand pumps can be started at the machines, and certain ones such as conveyors may be stopped from one or more local points.

Data on the connected loads and demands of a large number of the power applications with the corresponding figures for the entire plant will be presented in a subsequent issue.

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# Boulton Process for Southern Pine Poles

By J. D. MacLEAN*
*Senior Engineer Forest Products Laboratory*

**Used for green timber.**
**Forest Products Laboratory tests show advantages over usual steam process.**
**Time of treatment may be shortened.**

IT IS now common practice to condition green Southern pine poles by steaming and vacuum treatment. Little information has been available to show whether the Boulton process can be used for this purpose. The principal disadvantages of the steaming process are that the wood is subjected to considerably higher temperatures than are required in the application of the Boulton process and at best only a small amount of water can be removed from the wood even when long steaming and vacuum treatment is employed. Each method, however, has certain advantages not possessed by the other. In order to compare the two, several steaming runs were made.

It is recognized that more extensive tests are needed to determine fully the influence of the different variables involved. In addition it is desirable to check the laboratory results under commercial treating conditions. This study, however, has given important information regarding the practicability of employing the Boulton process for round Southern pine timbers and has provided data on the effect of different preservative temperatures and different vacuum periods on the amount of moisture removed.

In all treatments the maximum preservative temperature was maintained throughout practically the entire boiling period. In some runs about fifteen to twenty minutes was required to reach the maximum temperature, after which it was kept constant by means of a temperature regulator.

Preliminary air pressures used in these tests were 50, 75, and 100 lb. per square inch and the treating pressures were 125, 150, 160, 175 and 200 lb., 175 lb. being used in more than half of the treatments. *In these experiments an effort was made to obtain net absorptions of about 9 to 10 lb. per cubic foot;* an initial air pressure of about 75 to 100 lb. came nearest to accomplishing this purpose. A disadvantage of using high initial air pressures is that the preservative pressure must also be high, which in turn increases the tendency to checking.

The time required to reach the point where the rate of absorption was very slow varied from about two and one-half to four hours and averaged about three hours. In a number of treatments the pressure period employed was longer than necessary to reach approximately the point of refusal. It was maintained for fixed periods, however, so that the effect of other variables could be studied.

Four of the charges were steamed in order to compare the results with those obtained with matched specimens conditioned with the Boulton process. The boiling-under-vacuum periods were the same as the total steaming and vacuum periods employed for the matched pieces. In the steaming treatments the full steam pressure was applied at once and was held constant during the steaming period. The maximum vacuum in the steaming treatments was obtained within the first half hour after the vacuum was started and averaged about 25 in. of mercury.

In order to obtain data on the amount of water taken from the wood during the steaming and vacuum treatments one of the charges was removed from the cylinder and weighed immediately after the vacuum period was completed. In other charges the steam was shut off and the pressure was released through the condenser. The condensate, together with that obtained during the vacuum, was weighed at the end of the vacuum period. Since the wood was very green when steam was admitted it probably absorbed only a very small amount of mois-

**Abstract of paper presented at American Wood Preservers' Association.*

ture during the steaming period and it may be assumed that the weight of the condensate gave fairly close indications of the amount of water removed from those charges that were not weighed.

### Moisture reduction and distribution

The data show that the boiling treatments removed from 8 to 12 lb. of water per cubic foot in ten to twelve hours. Based on the average weight of these timbers when oven-dry this would be a reduction of about 25 to 40 per cent in average moisture content. Although in general the amount of water removed in a given time increased as the preservative temperature increased, the subsequent preservative treatment was not always improved by the greater reduction in moisture content made possible through high temperatures.

In the Boulton treatments the water did not start collecting in the flasks to an appreciable extent until two or three hours after the vacuum period had started. This was very likely partly because the vacuum had to be applied slowly and partly because of a lag due to the vapor capacity of the vacuum system.

In the steaming and vacuum treatments the amount of water removed averaged between 5 and 6 lb. per cubic foot, which was much less than that removed in the same period of time with the Boulton process. Even when the total steaming and vacuum period was twelve to thirteen hours the average reduction in moisture content was only about 17 to 20 per cent. Previous steaming experiments have shown that the moisture reduction that can be obtained by this process is very limited even when long and severe steaming conditions are employed. The Boulton process, on the other hand, will reduce the moisture content to any desired amount if boiling-under-vacuum is continued long enough.

In order to obtain information on the moisture distribution after treatment, sections about 5 in. long were cut from near the mid-length of some of the timbers and from these sections specimens about 1x1x5 in. were cut at 1-in. intervals from the surface. These specimens were oven-dried and the water evaporated from each piece was collected and weighed. The moisture content based on the average weight of the oven-dry untreated wood was then computed.

A comparison of the relative reduction in moisture in matched timbers shows that considerably greater reduction was obtained by the Boulton process than by the steaming and vacuum treatment in the same period of time. The data also show, as would be expected, that the moisture content near the surface may be much lower than it is a short distance beneath the surface. It is probable that with high boiling temperatures much of the water removed is from the wood near the surface and does not represent a proportional reduction for other parts of the timber. The timbers boiled at 235 deg. F. showed more or less surface checking and were difficult to bore with an increment borer, indicating that the moisture content at the surface was considerably below the fiber saturation point.

### Penetrations and absorptions

The most satisfactory results were obtained when preservative temperatures of about 200 deg. F. were used in both the boiling-under-vacuum and treating periods. A comparison of the results obtained in charges in which the timbers were matched shows that much better results were obtained when the temperature was 200 deg. F. than when it was 235 deg. F., the latter being the highest boiling temperature used. In other treatments 220 deg. F. apparently gave no better penetration, but increased the tendency to ring shakes more than did the temperature of 200 deg. F.

The net absorptions were much smaller and the penetrations were less in the steamed charges than in the charges conditioned by the Boulton process and impregnated under the same conditions. The net retentions in the steamed charges were not much over 4 to 5 lb. per cubic foot with the treating conditions used.

The amount of kick-back, expressed as a portion of the gross absorption, was higher in the steamed charges than in those conditioned by the Boulton method, but when expressed in pounds per cubic foot it was lower. Since the poles were green it is probable that some of the kick-back was caused by compression of the wood during the pressure period. When pressure is released the timbers resume approximately their original volume, thus producing a kick-back greater than would be obtained if the volume of the wood remained constant during the pressure period. The higher temperature of the wood in the steamed specimens, which helped increase the kick-back, and the greater amount of water in the wood cells were very likely largely responsible for the lower net retention.

On account of the small amount of material on hand the relative influence of moisture content and temperature on the net retention of the wood could not be studied in these tests. It is possible that when it is desired to limit the net retention to less than 10 lb. per cubic foot a lower absorption could be obtained by breaking the vacuum after 6 or 7 lb. of water per cubic foot had been removed, and then heating the timbers to a higher temperature. This possibility should be investigated in further experiments.

An examination of the data shows that out of the 25 boiling treatments that were made, both with and without vacuum, only two charges had less than an average of 75 per cent of the sapwood penetrated, five had 75 to 80 per cent penetrated, six had 85 to 90 per cent and twelve charges had 95 to 100 per cent of the sapwood penetrated. Of the steamed charges two had 75 per cent and two had 85 per cent of the sapwood penetrated.

### Occurrence of ring shakes and burst checks

Burst checks and ring shakes were more numerous and more severe in the steamed timbers than in those conditioned by the Boulton method. Some ring shakes occurred, however, even when the boiling and treating conditions were relatively mild. This fact would indicate that possibly this shipment of timber was very susceptible to the development of such damage. It may also be possible that ring shakes are more common in commercial treatments than is supposed and that they were found more easily in these timbers because all of the specimens were sawed transversely after treatment. In a number of the pieces the ring shakes occurred at a considerable distance from the surface. Ring shakes and burst checks also appeared to occur to a greater extent in timbers treated at high pressures than in those treated at lower pressures.

A comparison of the penetrations obtained in two specimens which were impregnated under the same pressure conditions shows that practically complete sapwood

penetration was obtained in the specimen given the Boulton treatment, whereas a considerable amount of sapwood was untreated in the specimen that was given the steam treatment.

Out of twelve specimens used in the four steaming treatments eight, or about 66 per cent, showed ring shakes or burst checks. Out of 75 specimens used in the 25 treatments in which the specimens were boiled at atmospheric pressure or under vacuum using different boiling temperatures 26, or a little less than 35 per cent, showed ring shakes or burst checks. Some of the ring shakes in the various specimens were small and normally would not have been found if the pieces had not been sawed after treatment.

### Conclusions

Experiments in the preservative treatment of green Southern pine poles showed that the Boulton process was much more effective than the steaming and vacuum process as a means of reducing the moisture content in such material. Where heavy absorptions of preservatives are required, such as in marine piling, the Boulton process may prove more satisfactory than the steaming process.

When it is desired to obtain net retentions of less than 10 lb. per cubic foot the steaming and vacuum process may be more suitable than the Boulton method because the tendency to heavy net absorptions is less in steam-conditioned pine poles. When absorptions of 10 lb. or more per cubic foot are specified steaming apparently has no advantages over the Boulton method either from the standpoint of time required for treatment or in the results obtained. On the other hand, besides being less effective as a means of removing moisture, steaming subjects the wood to higher temperatures and appears to cause more surface checking, ring shakes and burst checks.

These experiments indicate that the Boulton process offers possibilities of shortening the time required to condition the timber as compared with that required by the steaming and vacuum method. The time consumed, however, depends to some extent on the rate at which the vacuum can be raised without withdrawing creosote from the cylinder.

Penetrations obtained in both the steaming and in the boiling-under-vacuum treatments showed that complete sapwood penetration in all timbers cannot be easily obtained regardless of the process used. Although present specifications call for complete sapwood penetration in pressure-treated pine poles it is questionable whether any of the methods of treatment now employed can give complete sapwood penetration in all timbers in the charge when the net retention is limited to 10 lb. or less per cubic foot and the timbers have average sapwood thickness.

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# Cable vs. Open Wires for Service Drops

Foreseeing that, as customers observe the better appearance of cable over open wires, the demand for this type of service connection will grow, the Detroit Edison Company engaged recently in a preliminary study of the subject. For some time the company has used cable service drops where special conditions have made it necessary, but the purpose of the study was to determine the advisability of using cable as standard practice. From close observation of about 50 installations made with various kinds and sizes of cable and using different holding means on the pole and on the customer's structure the following conclusions were reached:

(a) Cabled service drops are better appearing.

(b) They are easier to run through trees.

Horizontal training wires (in the form of cable) across buildings do not require much room, hence there is less interference to windows, etc.

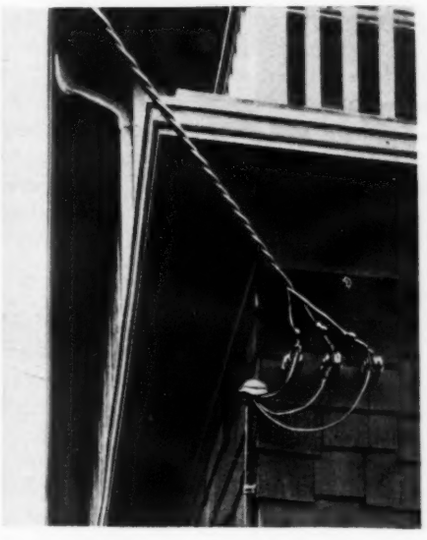
(c) When the ends of cable are opened and connected with the building circuits, as with open wires, the stringing tensions of cables are only slightly more than those of open wires, whereas usually the loaded tensions in cable during ice and sleet storms are much less than loaded tensions in open wires, hence there is less strain on poles and on buildings. [Sags conforming to company's standard were usual.]

(d) As long as the opened ends of cable are separately attached no difficulty should be had in holding the cable; and due to the elasticity of ties and copper wire the tension in the cable will distribute itself proportionately among the individual conductors.

(e) The fastening of cable as a unit (i.e., a one-point contact) is objectionable on buildings:

1. Because of possible damage to buildings.
2. Because of difficulty of holding cable.

It is objectionable on a pole because it limits the number of services that may be handled per pole.



**Twisted cable without braid and with conductors separately fastened appears to offer most promise**

(f) The increased carrying capacity of cable over open wires is a rather minor consideration.

(g) The cost of cable drops is decidedly more than the present method of open wire services.

(h) Whether maintenance charges on cable may be favorably compared with charges on open wire services is unknown.

The difficulties of installation and the added cost of cable services as exhibited by the foregoing conclusions are not taken by the company as definitely to disqualify cable services from further consideration. On the contrary, experimental and development work will be continued in the hope that these difficulties may be overcome and costs reduced. In this direction the use of twisted conductor cable without any inclosing braid appears to offer more promise than straight-lay cable with a braid. Also, if Code approval could be secured on a bare-neutral cable weights and costs would be reduced, the company believes.

# Adapting Oil Burners to Pulverized Coal Boilers

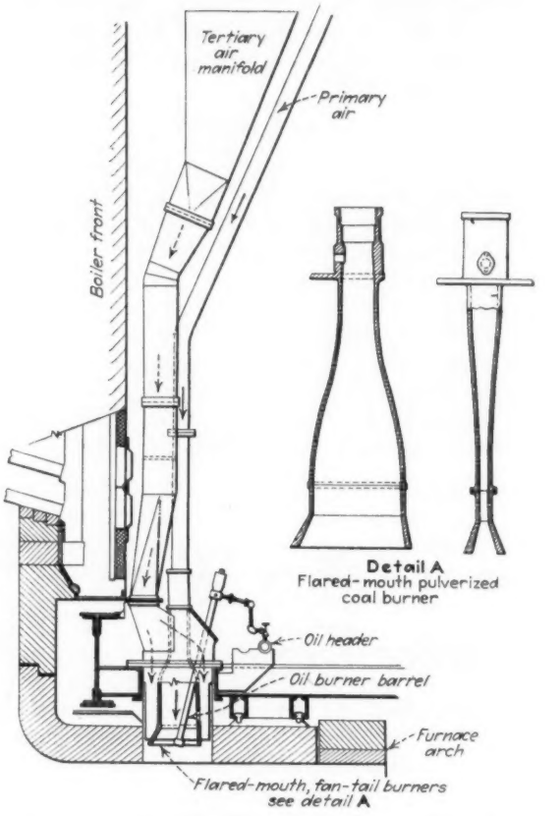
By E. F. WALSH
*Test Engineer Narragansett Electric Company*
*Providence, R. I.*

THE conversion of large pulverized coal-fired boilers equipped with vertical firing equipment to burn fuel oil or pulverized coal without making the conventional installation of turbulent combination burners has not been considered practical by manufacturers of fuel-burning equipment. In view of this situation the Narragansett Electric Company decided to experiment with vertical firing of fuel oil in its large pulverized coal-fired boilers. If the experiments proved successful savings in generation costs could be realized with less differential in prices of coal and fuel oil than had heretofore been possible.

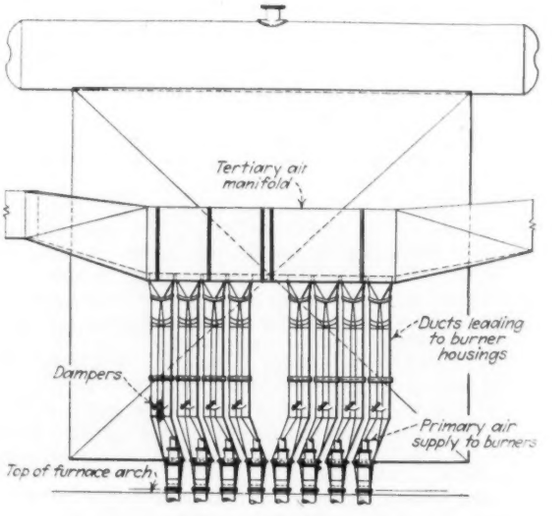
The original fuel oil burner installation at the South Street station was made in 1919 during a period of rising coal prices. Experiments were conducted with steam-atomizing burners and mechanical burners. Mechanical burners proved more desirable for the equipment installed, which resulted in their installation under 24 600-hp. three-drum longitudinal boilers. The installation was designed so that it was not necessary to remove the stokers. Bridge walls were removed, a false bottom was placed over the stokers and the burners were installed under the mud drum section of the boilers. This arrangement made it possible to shift from either fuel oil or coal within short notice. A shift in coal prices about 1924 required the changing of these boilers again to stoker-fired operation.

The year 1931 brought forth similar conditions of fuel prices as of 1919, which again necessitated changing from coal to fuel oil. During 1925 four 2,000-hp. boilers were installed. These were equipped with Lopulco furnaces and burners, the burners being installed in a short Detrick arch for vertical firing. The furnaces under three of these boilers were equipped with water-cooled walls on three sides, the fourth wall being an air-cooled ported wall for secondary air admission. The fourth boiler was similarly constructed, but was later changed to include water-cooled ported wall and arch of the block type. The arch tubes were extended across the furnace to form a slag screen and the sections of the tubes composing the arch were covered with refractory-covered blocks.

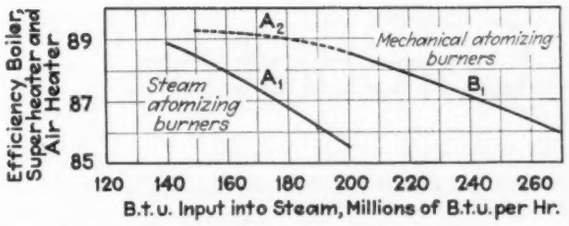
Preliminary studies indicated the conversion of these boilers to oil by installing mechanical burners of the register type in the ported walls and the rearrangement of the air supply in order that all air for combustion would pass through burner housings. In that new or booster forced-draft fans would have to be installed to obtain the necessary air pressure for proper atomization and combustion, experimental work was begun in an attempt to devise a method whereby fuel oil could be fired through coal-burner openings with low-pressure air.




**Location of oil burner and main air supply in relation to pulverized coal burner**




**Tertiary air manifold and connections to burner housings**




**Relative efficiencies obtained with mechanical and steam atomizing burners on similar boilers**

By virtue of higher capacity induced- and forced-draft fans, and additional heating surfaces installed on the boiler represented by $B_1$ curve, higher steaming rates were obtained than on the boiler represented by $A_1$ curve. The dotted line marked $A_2$ represents the efficiencies obtained on $A_1$ boiler after being converted to a mechanical oil burner installation.

Mechanical burners were first tried with various types of impeller plates and deflectors, but due to the fact that approximately 75 per cent of the air for combustion was admitted to furnaces at atmospheric pressure or slightly in excess of atmospheric pressure and over a large area, good atomization and mixing could not be obtained. Steam-atomizing burners were next experimented with. Several types of burners, many original in design, were tried with fair results. It was not possible, however, to obtain material for burner tips which would withstand the temperatures they were subjected to and the erosive action of the steam. A feature also desired was one which would enable a quick change from fuel oil to pulverized coal. Such a combination with steam-atomizing burners did not adapt itself to the equipment installed.

It was felt that mechanical burners could be made to operate satisfactorily if the greater portion of the air required for combustion could be admitted around the burners. With this thought in mind the burner assemblies and duct work were redesigned. This consisted of constructing new air ducts from the forced-draft fans to the coal-burner housings, which permitted approximately 70 per cent of the total air required for combustion, including the primary air, to be admitted through burners and burner housings. Flared tips were added to the fantail coal burners to form constricted areas in the air passages, thus obtaining high velocity air at the point of contact with oil spray. Holes were cut through each coal burner, through which were inserted the oil burner barrels. The oil burners were installed in a position to discharge into a path of primary air stream and low enough to prevent impingement of oil spray on the arch and front wall. Sufficient air is allowed to pass through the ports in the refractory walls for protection against overheating. Satisfactory atomization is obtained with an air pressure of 0.5 in. of water in burner boxes, as compared with five to ten times this pressure required with the conventional type of mechanical oil burner equipment. Primary air pressure of sufficient quantity is allowed to flow through fantail coal burners for obtaining proper flame length and to assist in atomization.

Complete analyses of the flue gases enabled a close check on the progress made in experimenting with the various types of burners and their arrangements. A sample analysis obtained with the final arrangement is as follows:

| | Per Cent | | Per Cent |
|---|---|---|---|
| Carbon dioxide | 14.50 | Carbon monoxide | 0.00 |
| Illuminants | 0.95 | Ethane | 0.00 |
| Oxygen | 2.67 | Methane | 0.00 |
| Hydrogen | 0.00 | Nitrogen | 81.88 |

Efficiency tests were conducted using calibrated oil meters, which were checked against weighed quantities and venturi meters for measuring the feedwater. Heat balance calculations checked these results within the usual accuracy. Test readings were taken over a two-hour period for each test, but test conditions were maintained at least six hours prior to each test. The accompanying illustration represents graphically the results obtained with mechanical and steam-atomizing burners fired vertically.

With mechanical oil burners installed as mentioned, it is possible to obtain higher $CO_2$ content in flue gases than with steam-atomizing burners. This, together with the elimination of the steam necessary for atomization, resulted in increased efficiency in favor of the mechanical burner installation.

Results obtained to date prove conclusively that fuel oil can be burned successfully in furnaces designed for pulverized coal and vertical firing without any changes in furnace design. Only minor changes are necessary to coal burners to make it possible to burn either pulverized coal or fuel oil within the period of time necessary to shut off fuel oil and start coal feeders. In installations where coal burners are equipped with tertiary air under pressure the changes in burner design necessary for conversion to burn fuel oil or pulverized coal would be minor.

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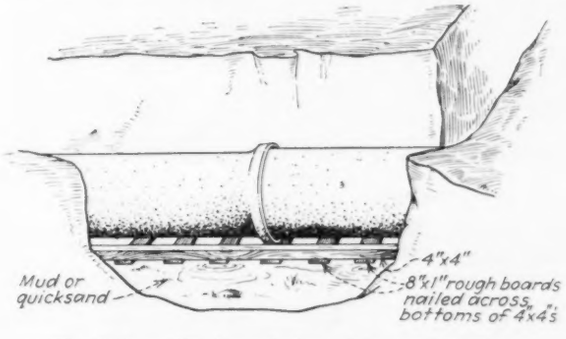
# Laying Large Pipes in Mud or Quicksand

By G. F. HARDEN

In central-station work it is often necessary to lay cement or vitreous pipes 3 to 6 ft. in diameter in mud or quicksand. If the pipe sections are laid in the bare trench and cemented without proper foundation the line quickly becomes distorted. To avoid this it has proved desirable to construct a wooden ladder of 4x4-in.




**"Duck-board" foundation for trench pipes preserves line-up**

timber and 8x1-in. cross pieces, laying this in the trench bottom before lowering the pipe into place. All the pipe should be lowered before starting to cement the lips. The ladder will sink out of sight in many cases on account of the weight of the pipe, but the line will remain true if the job is carefully handled and the trench is left open at least 48 hours to permit the cemented joints to set.

# A Free-Wiring Corporation

**Use of self-liquidating wiring corporation to give free wiring as an inducement to greater sales to homes. A speculation and a suggestion.**

OUR poor government collected a penny apiece from millions of school children and restored "Old Ironsides" with the proceeds. It is quite possible that a penny here and 1 per cent there could do equal wonders toward putting "Old Coppersides" more extensively into American homes. It is interesting to speculate on how little effort it would take to expand the wiring so that capacities and outlets can be established painlessly and yet offer an inducement to purchasers and sales agencies. Thus can that huge obstacle to range, water heater, ironer, refrigerator, floor lamp or any other sales resistance be removed. All that is needed is a popular "self-liquidating" project and organization.

Rough analysis makes it look as if a subsidy of 1 per cent or less of the gross revenue of manufacturers, wholesalers, contractors, retailers and utilities would provide a fund big enough to give $50 worth of free wiring to half the 20,000,000 homes over a five-year period. That may seem like a startling claim or a startling proposal, so some measure of substantiation is necessary.

During 1932 more than 9,000,000 household electrical devices were made, sold and put into energy-consuming service. If radio sets are included the total is more than 11,500,000. Some, of course, are replacements and do not represent a net addition to energy output. But, assuming for the moment that all did contribute to increasing kilowatt-hours, the total without the radios is more than 1,000,000,000 kw.-hr., and with the home radios included is more than 1,300,000,000. The retail value of the appliance sales was $240,000,000, or, including the radios, $355,000,000.

*Table I—New Appliance Energy Revenue Added in 1932*

| | Number Sold | Kilowatt-Hours per Year Each Unit | All Sales | Retail Value Total Sales |
|---|---|---|---|---|
| Cleaners, vacuum | 440,530 | 36 | 15,800,000 | $17,621,160 |
| Clocks | 2,400,000 | 17 | 40,000,000 | 12,000,000 |
| Cookers | 51,000 | 100 | 5,100,000 | 293,760 |
| Cookers (egg) | 32,000 | .... | ..... | 157,920 |
| Fans (desk and bracket) | 313,000 | 10 | 3,130,000 | 2,504,000 |
| Fans (household ventilating) | 13,800 | 40 | 550,000 | 276,000 |
| Heaters and radiators | 178,700 | 40 | 5,450,000 | 640,000 |
| Heating pads | 321,300 | 18 | 5,780,000 | 1,180,000 |
| Hot plates, stoves, grills | 273,140 | 34 | 9,300,000 | 655,200 |
| Irons | 1,858,400 | 72 | 134,000,000 | 7,161,920 |
| Oil burners | 68,000 | 200 | 13,600,000 | 7,800,000 |
| Percolators | 201,600 | 50 | 1,080,000 | 1,696,000 |
| Sewing machines | 133,000 | 10 | 1,333,000 | 10,374,000 |
| Toasters | 960,000 | 50 | 48,000,000 | 3,100,000 |
| Waffle irons | 458,700 | 60 | 2,750,000 | 1,834,800 |
| Washing machines | 569,830 | 240 | 136,750,000 | 33,619,970 |
| | 8,277,000 | | 422,600,000 | $10u,914,730 |
| Ranges | 60,000 | 1,500 | 90,000,000 | 9,000,000 |
| Refrigerators | 770,000 | 725 | 558,250,000 | 130,860,000 |
| | 9,107,000 | | 1,070,870,000 | $240,774,730 |
| Radios | 2,500,000 | 100 | 250,000,000 | 115,280,000 |
| | 11,607,000 | | 1,320,870,000 | $356,054,730 |

The details are shown in Table I, taken largely from the January, 1933, statistics of *Electrical Merchandising*. In this set-up $25,000,000 is deducted from the $32,800,000 of sales of oil burners to reduce the figure to a reasonable value for the strictly electrical components. Likewise, $16,000,000 is taken off the $146,000,000 for refrigerators to cover the installation cost and leave a figure which more nearly represents the retail sales price of the equipment.

Scrutinizing these data for potentiality to produce the fund described must be done with a full realization of the fact that all parties will be interested in sales, but all will not have an equal interest in promoting additional wiring or in selling appliances. But the prime objective in this speculation is to show possibilities. Probabilities and actualities would only ensue as the merit of such a proposal received recognition and, with it, a more intensive analysis of respective gains and respective responsibilities.

Approaching the problem from the standpoint of the objective, the more fully electrified home with free wiring as an inducement will reveal the magnitude of the capital outlay and the corresponding carrying charges on the financial set-up of an industry self-liquidating corporation for wiring. Suppose $50 on the average would add a useful amount of new wattage wiring capacity and new outlets for half of the country's 20,000,000 wired homes. Suppose, further, that the program could be planned for a five-year execution. That would take a capital fund for wiring of $100,000,000 to be available to wiring contractors for the national job through a self-liquidating corporation. Suppose, further, that bonds, debentures and/or stocks of the corporation could be sold within or without the industry on an average return of 6 per cent. That would take $6,000,000 a year for interest. Amortization over a six-year period would take about $14,000,000 to retire the first year's issue within a year after the last of the five issues had been subscribed. In other words, $20,000,000 a year for eleven years would put $500,000,000 worth of added wiring into 10,000,000 homes in five years provided each wiring job is accompanied by the sale of an electrical device.

### Contribute in proportion to business gained

How can $20,000,000 be found? From Table II it appears that less than 1 per cent of gross sales revenue from each of the groups only would easily provide such a fund. In each case the *justification would have to be found for making any such contribution on the basis of profits to be derived from an enlarged market.* One cent

*Table II—Free-Wiring Fund Derivable from Industry Revenue*

| | Domestic Appliance Business | | Contribution to Wiring Fund | |
|---|---|---|---|---|
| | Without Radio | With Radio | Per Cent | Amount |
| Electrical manufacturers | $120,000,000 | $180,000,000 | 1 | $1,800,000 |
| Wholesalers | 160,000,000 | 240,000,000 | ½ | 1,200,000 |
| Retailers | 240,000,000 | 355,000,000 | 1 | 3,550,000 |
| Utilities | *42,800,000 | 52,800,000 | *25 | *13,270,000 |
| | $562,800,000 | $827,800,000 | | $19,820,000 |

*This means added revenue at 4 cents per kilowatt-hour on consumption by new appliances sold in 1932 with a contribution of one cent per kilowatt-hour which represents 0.6 per cent of the whole utility business or 2 per cent on all domestic revenue.

a kilowatt-hour from the utility industry from only those kilowatt-hours consumed by the new devices sold during the very lean year 1932 would provide two-thirds of the needed fund. That $13,270,000 would constitute only 0.6 of 1 per cent of their gross revenue or 2 per cent of the revenue from domestic energy sales. One per cent from the retailer of all household appliances including radios would give more than $3,500,000. The residue of $3,000,000 could come from the appliance and wiring manufacturers (1 per cent of gross) and the wholesalers and contractors (one-half of 1 per cent).

Eliminate radios if you must. Eliminate the smaller hand appliances if you must. Leave only ranges, refrigerators, ironers, oil burners, water heaters and washing machines and there is still the basis for a program that will let all these and the other devices be sold or rented without the market resistance that comes from obsolete and inadequate wiring. To reduce the unit contributions from all groups, the small appliance manufacturers, apparatus manufacturers, the wire manufacturers, the wiring device manufacturers and dealers, the lamp manufacturers and dealers, the jobbers, the utilities and the wiring contractors should all participate. Whatever the composition of the group or however extensive or limited the area over which such a plan could be made effective, there are possibilities in the picture. The incentive to sales agencies would be used as the lever for their activities and the customer sales resistance to expenditures for wiring would be eliminated.

**Subsidy for range wiring equal to year's revenue**

Hartford is renting ranges on a basis which, roughly, means converting the whole of the $45 prospective revenue from a year's use of a 1,500-kw.-hr. range at 3 cents into a maximum cash subsidy of $45 for free wiring. The actual subsidy on the average is considerably less than this, of course. But it means a subsidy that absorbs half or more of the prospective revenue for the first year. Many other utilities have gone far in adopting free wiring. Many would be more receptive toward this idea if a share of the burden could be borne by other interests who stand to profit by the market for appliances which only awaits the provision of more ampere capacity and more points of escape for those amperes.

In view of the modest amounts needed from the respective sources to make such a large-scale program possible it is seriously proposed that industry agencies survey the situation to ferret out the scope which could be given to it. Much more will have to be done than has been intimated sketchily here. There will be obstacles to enlistment of full participation of each group. There will be hesitancy to accept any particular percentage of gross as being wholly equitable for each group. There will be hesitancy to adopt the plan as a comprehensive national one until it has been tried in a local area and its feasibility demonstrated. There will be a tendency to restrict the discussion to the heavy-duty appliances. One can think of even more deterrents.

But against all the impediments set the imperative task of building home usage up to twice, thrice and even five times its present volume. Against them set the imperative task of finding an outlet for the unused productive capacity of the $2,500,000,000 electrical manufacturing industry and the almost unlimited expansion of the power industry to supply the market. This is a time for logical experiments in market development.

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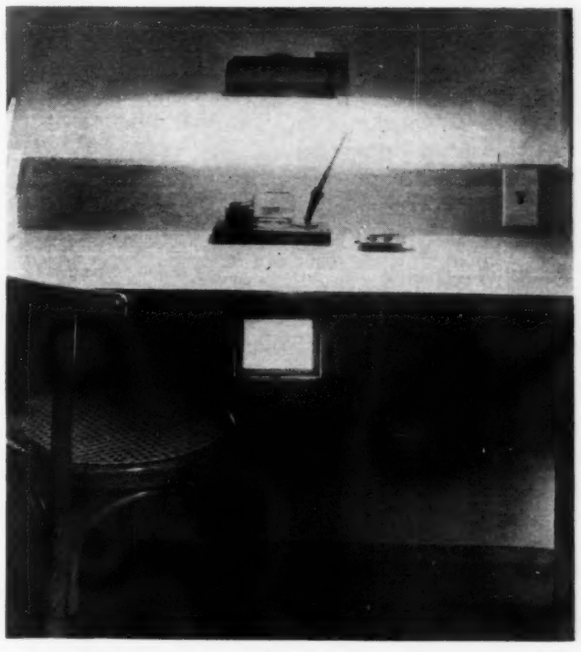
# Coupon Loss Averted by Special Lighting



Placing a light beneath the desk in the coupon booths of the new Emigrant Industrial Savings Bank in New York City was the measure adopted by the architects, Voorhees, Gmelin & Walker, to avert the annoying loss of coupons by hasty and preoccupied coupon clippers. Twenty foot-candles is provided on the counter surface from a 25-watt lamp in a broadly distributing unit devised by Cox, Nostrand & Gunnison. Under the counter is a rectangular flush box faced with a glass plate and aluminum louvers behind which is a 40-watt "Mazda" lamp.

A tumbler switch close to the wall unit controls both lights. A second switch is placed below the shelf in such a position that the attendant must bend down and thus be close to the floor. He can readily determine if any coupons or securities have been dropped.

# READERS' FORUM

## Surge Absorbers Reduce Wave Steepness

*To the Editor of the* ELECTRICAL WORLD:

In your issue of March 4 you published a letter from H. V. Putman of the Westinghouse company commenting on your previous editorial article on the subject "Shunt or Insulate Transformers." Mr. Putman's article reminds me of the hero in one of Stephen Leacock's humorous sketches, who "mounted his horse and rode off rapidly in all directions."

He mentions the obsolete choke coil, promises the continuance of the reinforcement of end turn insulation and promises that "refinements will be found" in higher voltage classes. He expresses his views on the feasibility of commercial surge testing, which subject was discussed without unanimity of opinion at the winter convention of the A.I.E.E. He makes the questionable statement that the "surge-proof power transformer costs not one penny more," but he makes no reference whatsoever to the problem of protecting thousands upon thousands of transformers now in service. He concludes his letter with ill-informed statements regarding the functional operation of the surge absorber.

He specifically imputes to the surge absorber proponent the claim that "magnitude does not matter." No engineer sponsoring the surge absorber claims for a moment that magnitude does not matter. Surge absorbers were developed primarily for the protection of transformer windings. We claim simply that, as Mr. Putman himself emphasizes, failure will take place above a given magnitude but not below it, and in a modern transformer as manufactured by several reputable companies the insulation strength to ground is such that the magnitude of any surge which can be held on the line without insulator flashover will be below the breakdown strength of the transformer insulation to ground, with or without lightning arrester protection of the discharge type.

But—and now keeping in mind Mr. Putman's reference to the time lag curve of insulation—a surge with a one microsecond front traveling into and through the transformer, at almost 1,000 circuit feet per microsecond, places the full amplitude stress of the surge across a section of the winding. Under certain conditions this might be between adjacent turns at the ends of a back-turn section of the coil. The *amplitude of this internal stress* is many hundred times higher than the normal voltage for which the transformer is insulated, and quite naturally the transformer breaks down.

Without digressing to debate the feasibility of providing additional insulation against these stresses, or otherwise safeguarding the insulation *without extra cost,* but considering still the thousands of transformers now in service, it seems to me it should appear tremendously important to the operating engineer that the surge absorber does change the slope of the wave front and consequently does minimize these internal stresses, which the transformer manufacturer knows from experience cause the great majority of transformer failures.

That this fact is not questioned, may I refer to Mr. Putman's associates. In the March issue of the *Electric Journal* Messrs. Calvert, Monteith and Beck, in an article entitled "Surge Protection for Rotating Machines," state:

> Protecting a rotating machine against a surge involves doing two things—limiting the magnitude of the surge and the steepness of the wave front to minimize the stress on the turn insulation.
>
> The magnitude of the voltage to ground can be limited by a lightning arrester.
>
> The rate of rise of voltage can be definitely limited by a capacitor at the machine terminals, charged through an impedance. It will have a definite charging rate and consequently a definite rate of rise in voltage. *The result is a definite limitation of the stress placed on the turn insulation.*

Separately, A. M. Opsahl, circuit breaker engineer of the Westinghouse company, in a report regarding a Ferranti surge absorber which he had tested, makes these important statements:

> The *steepness of the wave front is reduced,* but the amplitude of the wave may or may not be affected. The surge absorber has its greatest effect on the wave front.
>
> The effect of the surge absorber is due very largely to its electrostatic capacity between line and ground. A surge arriving over a transmission line is sloped off by an amount depending on the steepness of the original wave.
>
> From the oscillograms taken, it is evident that the loss effect in the dissipator is sufficient to prevent the system of capacity and inductance from oscillating.

Thus, in effect, Messrs. Calvert, Monteith and Beck say the reduction of between-turn stresses can be accomplished by a combination of inductance and capacitance, and Mr. Opsahl finds that the Ferranti surge absorber (which is such a combination) not only does accomplish it, but does so without setting up an oscillatory condition.

And may I further invoke assistance from the Westinghouse engineers to confirm our contention that transformer failures due to lightning are internal failures due to the steepness of the wave front, and not failures to ground due solely to amplitude. In his discussion of Mr. Putman's paper before the winter convention of the A.I.E.E. S. M. Dann, in replying to Mr. Palueff's reference to the Westinghouse 220-kv. transformers at Leaside, says of one of the failures:

> There was no failure to ground—it was purely a failure across the high-voltage group of coils, etc.

In other words, the failure was due to the steepness of the wave front, the very thing the surge absorber corrects. The surge absorber is not offered to American engineers as an untried experiment; thousands of absorbers are in service. Many of them have been installed to replace lightning arresters which have failed to give protection, and yet I have never heard of a transformer which has failed by lightning when properly protected by surge absorbers.

I believe that those engineers who have lightning problems will feel justified in making a careful study of the theory of surge absorber protection. From the nature of things, surge absorbers will be tried out cautiously, and in most cases in those locations where lightning conditions are known by experience to be severe. We accept this condition gladly. More than 80 per cent of the surge absorber orders to date have come from users who, under such conditions, have had at least one year's operating experience.

**A. B. COOPER,**
Vice-President.
Ferranti Electric, Ltd.
Toronto, Canada.

# Men of the Industry

### *S. C. Moore New President of Narragansett Electric*

Samuel C. Moore, ranking executive of the New England Power Association in charge of subsidiary operations in southern New England, has recently been elected president of another unit in the system, the Narragansett Electric Company. Mr. Moore is also president of the Rhode Island Public Service Company (ELECTRICAL WORLD, March 26, 1932, page 589). He has been intimately connected with the development of the New England Power System since 1912.

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JAMES WILSON, secretary for many years of the Shawinigan Water & Power Company, Montreal, has been elected a vice-president of that company.

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WARREN H. JONES, secretary of the Westinghouse Electric & Manufacturing Company, has been elected a director of that company to complete the term of the late Edwin M. Herr, and C. A. TERRY, honorary vice-president, has been elected to the directorate for four years.

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FRED B. LEWIS, vice-president and general manager, and ROY V. REPPY, vice-president and general counsel, of the Southern California Edison Company, Ltd., have been elected members of the board of directors of that utility.

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LELAND D. MCCORMAC, formerly assistant to the vice-president of the Utica (N. Y.) Gas & Electric Company, has been named general manager of that company. Mr. McCormac became identified with the Utica utility seven years ago as land and tax agent. Previously he was associated with Frank Williams and Roy Finch, formerly state engineers, and for seven years was secretary of the State Engineering Department in Albany.

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DOUGLAS M. BURCKETT has been assigned to the duties of the late L. C. Winship, electrical engineer of the Boston & Maine Railroad, with headquarters in Boston. Mr. Burckett was educated at the Massachusetts Institute of Technology in electrical and hydraulic engineering. After graduating in 1922 he was employed by the Washington Water Power Company, Spokane; the Sydney Jenkins Company, Ltd., Vancouver, B. C., and by the Great Northern Railway as assistant electrical engineer. He joined the Boston & Maine in 1929 as electrical engineer of the engineering department and will continue this work in his enlarged responsibilities.

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### *Hellmund New Chief Engineer of Westinghouse Electric*

Rudolf E. Hellmund, since 1926 chief electrical engineer of the Westinghouse Electric & Manufacturing Company, has been elected chief engineer of that company. For many years Mr. Hellmund has been known in the electrical industry and allied fields for his inventive genius and his contributions to the design of new and improved apparatus, having to his credit approximately 300

patents taken out in the United States and abroad covering the details of apparatus and systems of control and operation. A native of Germany, he had had some experience in designing electrical machinery in his native land. Following the completion of his technical studies at the Ilmenau Technical College he spent four years in practical work with Poeschmann & Company, Dresden, with the Land & Sea Cable Works at Nippes and with the Esslingen Machine Works at Stuttgart.

In 1903, after taking certain postgraduate work at the University of Charlottenburg, Mr. Hellmund came to the United States and after a short time became associated with William Stanley in Massachusetts upon the design of motors and alternators. After engaging in similar work with the Western Electric Company he joined the Westinghouse Electric & Manufacturing Company in East Pittsburgh in 1907 and in 1912 was placed in charge of the design of all direct- and alternating-current motors for light and heavy traction. In 1917 he was assigned miscellaneous consulting work, in which he continued until 1921, when he was made engineering supervisor of development. It was seven years ago that he was appointed chief electrical engineer.

The Lamme medal of the American Institute of Electrical Engineers, one of the outstanding tributes of the industry, was awarded to Mr. Hellmund three years ago for his contributions to the design and development of rotating electrical machinery. He has been prominently identified with the affairs of the Institute, of which he is a fellow, for a number of years, having contributed many papers which have appeared in the *Transactions* of that society. He has also contributed articles and discussions to the *Proceedings* of the British Institution and to various other American and foreign technical magazines.

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## OBITUARY

CHARLES A. ROUNDS, for many years prominent in the electrical contracting field at Boston, Mass., died at his home in Newton Center, April 13. He was 54 years of age and was a graduate of the Massachusetts Institute of Technology. At the time of his death he was New England representative of the Electrical Research Products Corporation of New York and was president of the Rounds Talking Pictures Corporation of Boston.

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CHARLES J. REED, well-known inventor and engineer, died at his home in San Mateo, Cal., April 11 at the age of 74. Mr. Reed, one-time assistant to Thomas A. Edison, was prominently identified with the electrochemical industry for many years, having been one of the founders of the American Electrochemical Society. He was active in the establishment of *Chemical and Metallurgical Engineering*, a McGraw-Hill publication, and in the course of his career was a frequent contributor to the technical and scientific press. Mr. Reed was born in Iowa and received his A. B. degree from the University of Michigan in 1881. Five years later he began practice as an electrical engineer.

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COL. SAMUEL REBER, wireless expert and general foreign representative of the Radio Corporation of America, died April 16 at the Walter Reed General Hospital, Washington, D. C., at the age of 68, after an illness of more than a month. In the course of a distinguished military career, Colonel Reber represented the War Department at many international conferences on wireless communication and after retiring became associated with the Radio Cor-

poration. In 1893 he was a delegate to Section B of the International Electrical Congress, a member of the electrical juries of the Chicago and St. Louis exhibitions, a War Department delegate to the International Electrical Congress in 1904, and was a delegate to the World Engineering Congress, Tokyo, in 1929. Colonel Reber was born in St. Louis, was graduated from the Military Academy in 1886 and from the Army War College in 1905. He reached the rank of colonel in 1916 and was retired at his own request in 1919. At the time of his death he was vice-president of Radio Corporation of America Communications, Inc., and general foreign representative of that company, as well as of the Radio Corporation of America. He was a fellow of the American Institute of Electrical Engineers, a member of the Institute of Radio Engineers and a member of the Franklin Institute.

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# New Equipment Available

## High-Speed Electric Die Grinder

A Bosch high-speed electric die grinder which is a compact precision tool, ideal for finishing patterns and dies, is announced by the United American Bosch Corporation, Springfield, Mass. Its exceptionally high spindle speed of 50,000 r.p.m. without vibration enables it to do classes of work where no other grinder can be used and also permits the use of extremely small wheels 5/64 to 5/8-in. diameter. It is possible to grind with great accuracy extremely small radii and to reach heretofore inaccessible places, it is claimed. Its pistol grip "Resistox" housing provides a practical and attractive appearance.

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## Multi-Temperature Indicator

Known as the "Electrotemp," a temperature recorder which measures the entire range from ice point to steam point has been announced by the Westinghouse Electric & Manufacturing Company. With this development it is possible to check temperatures at a central point from remote divisions of buildings or properties.

The apparatus required for the installation of the "Electrotemp" is simple. All that is necessary is ordinary bell wire leads from the temperature control to the search coils located at different points throughout a building. After plugging into the regular house lighting circuit, the apparatus begins to work. The search coils, which are sensitive detectors of temperature, consist of pieces of copper wire in a small compact metal plate, with an artistic cover plate which can be screwed to the wall, mounted outdoors or even inserted into the hot water system or the electric refrigerator.

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A DEVELOPMENT IN ARC WELDING suited to the joining of heavy plates, known as the "Murex" straight gap welding, has been announced by the Metal & Thermit Corporation, New York. The new process does away with all need for veeing or grooving of plate edges. Plates may be used just as they come from the mill. Greater welding speed and appreciable reductions in cost are claimed. The developers of the process say that it cuts welding time in half and, by eliminating all preparatory work and reducing the quantity of weld metal required, achieves real economy in welding heavy plates.

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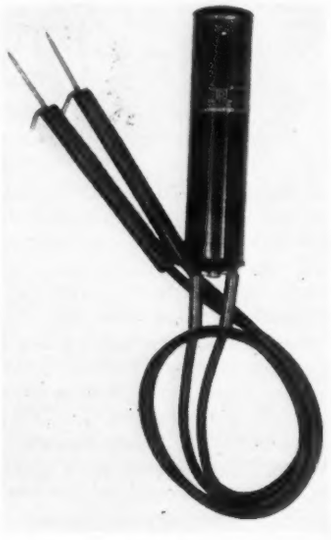
## Voltage Tester Requires No Lamps

A voltage tester that requires no lamps and registers accurately the voltage as well as indicating whether it is a.c. or d.c. is announced by the Square D Company, Detroit, Mich. The tester is



inclosed in a rugged fiber case so that there is no danger to the operator or to the tester.

It is simple to operate, it is claimed; all that is necessary is to place one wire in each side of the circuit and the indicator shows what the voltage is. A.c. voltages are shown by the slight vibration of the indicator.

## Magnet Brakes Incorporate New Features

Radical departures from familiar practices in brake design have been made in the development of a new line of magnetic brakes, according to the Wrought Washer Manufacturing Company, Milwaukee, Wis. These new brakes use only a fraction of the power required by other brakes, it is claimed. As the solenoid operates on a lever arm ratio of 27 to 1, only one-twenty-seventh the power is required on the solenoid.

The user can easily change the ratio of the brake so it is always loaded to capacity. Thus a 100-ft.-lb. brake will operate properly on a 50-ft.-lb. load. The brake may be released by hand when desired. Another extremely desirable feature is the fact that it will operate on any frequency, either a.c. or d.c.

▼

A SPLASH-PROOF MOTOR designed for use in breweries, dairy plants and similar places where water or other liquids may be splashed on the motor has been announced by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. The motors are made in all sizes from 1 to 200 hp. as squirrel-cage induction motors and meet all classifications of torque and inrush requirements.

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A NEON LIGHTNING ARRESTER for protection of low-voltage circuits, such as telephone, fire and police signaling, railway signaling, etc., is announced by the L. S. Brach Manufacturing Corporation, Newark, N. J. The arrester consists of a small glass tube containing two specially chemically treated metal electrodes in neon argon gas.

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WHERE MECHANICAL MEANS is required for reducing the normally high motor speed to satisfactory operating speeds the new line of type S Westinghouse gear-motors provides an extremely simple and compact unit for low operating speeds. Designed for drives from ½ to 75 hp. and for 1,550 to 232 r.p.m., this advanced type of drive may be connected direct to the driven equipment or by cog belts, chains or flat belts.

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TD-7 HOT WIRE TIME DELAY, designed for applications where a short time delay is desirable and where rapid but not immediate recycling is required, is announced by Struthers Dunn, Inc., Philadelphia, Pa. The unit consists of a hot wire member, a bow member and two adjustable, fixed contacts, all mounted on a base of insulating material. It is designed for delays from one to five seconds, and the time of cooling is proportional to the time of heating up.